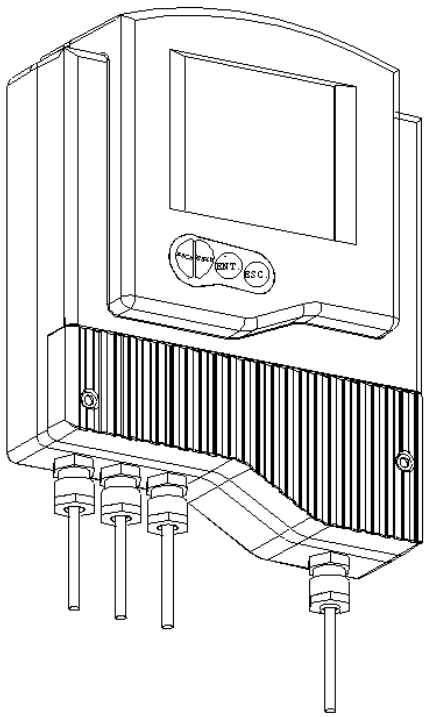
SmartScan
User's Manual

for SmartScan 25/50



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Date	Revision	Software Version	Catalog Number
May, 2011	2.2	5.06 - 2.05 - 3.08 -	680003D

Safety Guidelines

Please review the following points before installing and operating the SmartScan system.

- SmartScan must be installed, connected and operated according to the instructions in this Manual.
- If installed incorrectly or used for applications for which it is not intended, application-related dangers may arise.
- Only qualified personnel are authorized to install and operate SmartScan.
- When SmartScan is reopened, ensure that you replace the O-ring, in order that the unit will remain sealed (for IP67 units). The O-ring is suitable for one use only.
- Modifications and repairs to SmartScan are permissible only when the manufacturer expressly approves them.

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Chapter 1

Introducing SmartScan

SmartScan is a non-contact, ultrasonic, continuous-level measurement instrument that is able to provide accurate measurements for both liquids and solids, while automatically compensating for changes in temperature and other environmental conditions. SmartScan is designed for applications such as process tanks, storage vessels, open air piles, open channels, and so on.

SmartScan is a four-wire, low-voltage device, and is available with a customized graphic LCD display. SmartScan has two major components, the main control unit and the sensor (connected via a cable).

- **Main (electronic) control unit:** If required, this component can be optionally wall mounted, using a wall-mount plate, or panel mounted. To ensure proper operation, the unit must be installed up to 200 m (656 ft) from the sensor and 100m (328 ft) for EX sensors.
- **Sensor and data cable:** The sensor is supplied with the data cable attached. See description of available cable lengths in Page 16.
- The installation procedure and wiring connections for these components are described in *Chapter 2, Installing SmartScan*.

The SmartScan product line comprises two families, SmartScan 25 (25 KHz) and SmartScan 50 (50 KHz), each with its own models (as listed below). A variety of sensors are available for SmartScan 25, suitable for different ranges.

SmartScan 25:

- SmartScan **L** for liquid (Standard Range/Long Range)
- SmartScan **S** for solid (Standard Range/Long Range)
- SmartScan **O** for open channel (Standard Range/Long Range)
- SmartScan **R** for Liquid short Range (SmartLite).

SmartScan 50:

- SmartScan **L** for liquid
- SmartScan **S** for solid
- SmartScan **O** for open channel

The following diagrams show the front and side views of SmartScan, and its dimensions in millimeters:

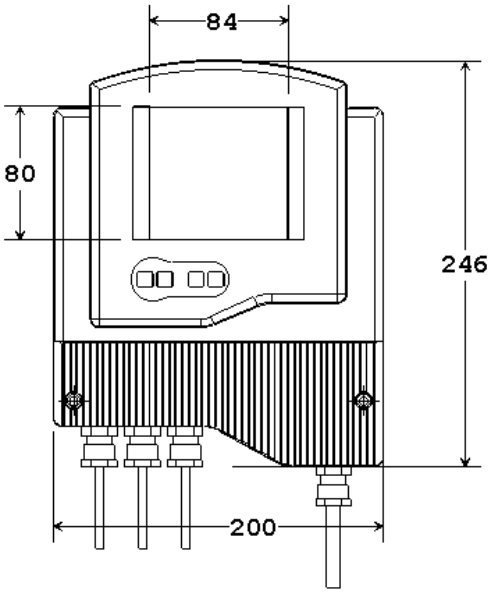


Figure 1: Front View of SmartScan

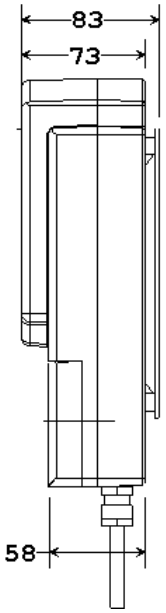


Figure 2: Side View of SmartScan

The following schematic diagrams show the wall-mount and panel-mount options, with the dimensions in millimeters:

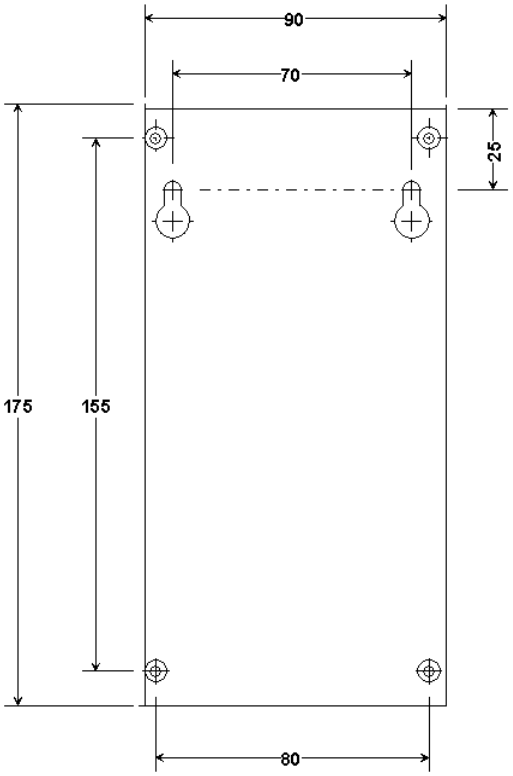


Figure 3: Wall-mount Plate

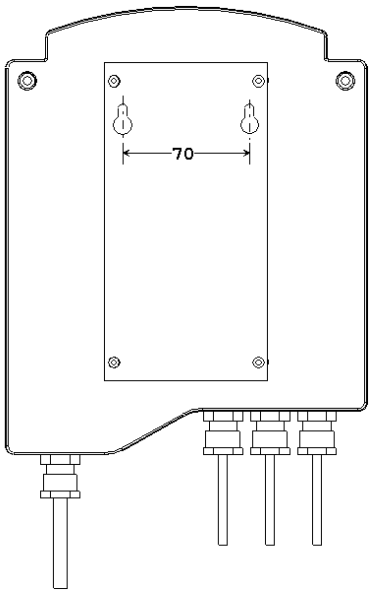


Figure 4: Back View of SmartScan with Wall-mount Plate

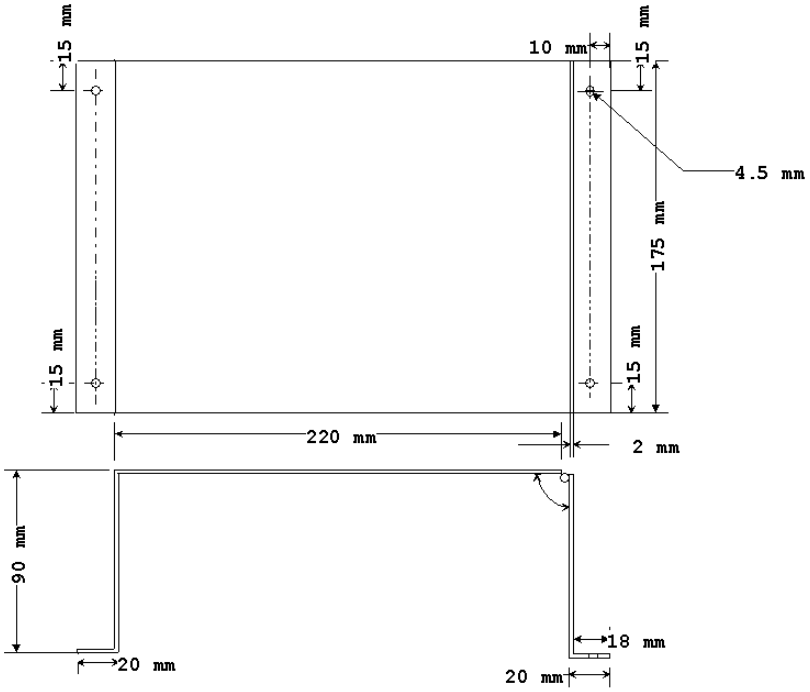


Figure 5: Panel Mount

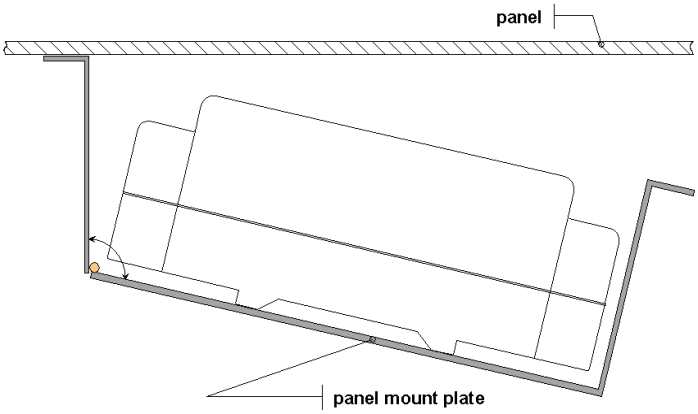
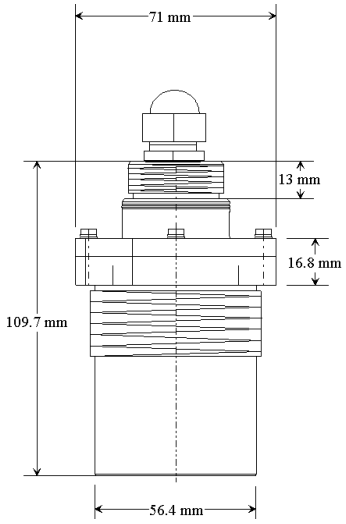


Figure 6: Top View of SmartScan with Panel-mount Installation

Sensor Dimensions

25 kHz Standard Range



25 kHz Long Range Sensor

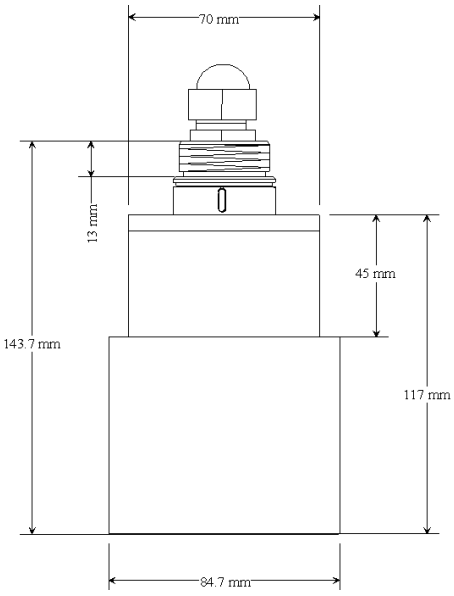


Figure 7: SmartScan Sensor Dimensions

50 kHz Sensor

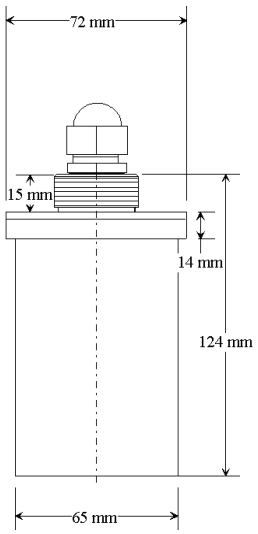


Figure 7 (Cont.): SmartScan Sensor Dimensions

SmartScan 25 Specifications

Measuring Ranges

Short Range (Lite)	**25R**	0.6 m to 10 m (2 ft to 32 ft)
Standard Range	**25S**	0.6 m to 20 m (2 ft to 64 ft)
	25L, 25O	0.6 m to 25 m (2 ft to 82 ft)
Long Range	**25S,**	0.6 m to 30m (2 ft to 98 ft)
	25L, 25O	0.6 m to 40 m (2 ft to 131ft)

Hazardous Installation version:

Short Range* (Lite)	**25R**	0.6 m to 10 m (2 ft to 32 ft)
Standard Range	**25S**	0.6 m to 15 m (2 ft to 49 ft)
	25L, 25O	0.6 m to 20 m (2 ft to 64 ft)
Long Range	**25S,**	0.6 m to 20 m (2 ft to 64 ft)
	25L, 25O	0.6 m to 25 m (2 ft to 82 ft)

Accuracy

SmartScan	**25L, 25S, 25O,**	0.25% of the measuring range
SmartScan Lite	**25R**	0.30% of the measuring range
Resolution		1 mm (0.04")
Ambient temp' compensation		Automatic

Mechanical Specifications

Enclosure	IP 65/67 (NEMA X4/X6), plastic ABS, wall mount/panel mount
Pollution degree	2 (as per IEC61010)
Insulation category	II (as per IEC61010)
Mechanical fitting	Gland connection Pg9 Conduit connection 1/2" NPT Conduit connection M20 x 2.5
Temperature range	DC model: -40°C to 60°C (-40°F to 140°F) AC model: -20°C to 60°C (-4°F to 140°F)
Dimensions	272 mm x 200 mm x 85 mm (10.7" x 7.9" x 3.3")
Weight	1.6 kg (3.5 lb.)

Sensors

Wetted parts	Polypropylene (PP) (PVDF: optional), SS or coated aluminum (ECTFE / Halar)
Signal power between unit and sensor	Min. range: 4Vp-p Max. range: 80Vp-p
Operating pressure	Atmospheric
Operating temperature	-40°C to 80°C (-40°F to 176°F)**
Mounting	1" BSP or 2" BSP, 1" NPT or 2" NPT
Transducer	25 kHz

Hazardous Installation version:

Max. cable length between unit and barriers	Up to 25m (82ft)
between sensor and barriers	Up to 75m (246ft)

Electrical Specifications

Display	Customized LCD
Supply	18 to 30 VDC (0.25 A max), (external fuse: Slow Blow 1A T type***) **or** 100 — 230 VAC, 50/60Hz, 70mA Max.
Outputs	4-20 mA, 750 Ω load @ 24 VDC
Interface	RS-232 or RS-485
Protocol	Modbus — RTU****
Relays	5 independent SPDT

Certifications

CE - EMC,FMC, FM — Safety, FCC

Transmitter:

FM, (Classified): Non Incendive, Class I,II,III/ Division 2/ Groups ABCDFG/T4

Sensor:

ATEX: II 1G, EEx ia IIC T4 (Ta = -40°C to +70°C)
EEx m IIC T4*
FM, (Classified):
Intrinsically safe Class I,II,III/Division 1/ Groups ABCDEFG/T4
Non Incendive, Class I,II,III/Division 2/ Groups ABCDFG/T4

Characteristics

Level, distance, flow, volume, kilograms and totalization.

* Consult factory

** IS model temp' range is 70°C

*** Recommended type: 0034.3117 Schurter

**** Consult factory for the Modbus user manual.

SmartScan 50 Specifications

Measuring Ranges

SmartScan 50L	0.4 m to 12 m (1.3 ft to 39.4 ft)
SmartScan 50S	0.4 m to 8.5 m (1.3 ft to 28 ft)
SmartScan 50O	0.4 m to 12 m (1.3 ft to 39.4 ft)

Accuracy

SmartScan 50L	0.2% of the measuring range
SmartScan 50S	0.25% of the measuring range
SmartScan 50O	0.2% of the measuring range

Mechanical Specifications

Enclosure	IP 65/67 (NEMA X4/X6), plastic ABS, wall mount/panel mount
Pollution degree	2 (as per IEC61010)
Insulation category	II (as per IEC61010)
Mechanical fitting	Gland connection Pg9 Conduit connection 1/2" NPT Conduit connection M20 x 2.5
Temperature range	DC model: -40° C to 60° C (-40° F to 140° F) AC model: -20° C to 60° C (-4° F to 140° F)
Dimensions	272 mm x 200 mm x 85 mm (10.7" x 7.9" x 3.3")
Weight	1.6 kg (3.5 lb.)

Sensors

Wetted parts	Polypropylene (PP) (PVDF: optional), glass reinforced epoxy
Operating pressure	Atmospheric
Operating temperature	-40° C to 100° C (-40° F to 212° F)
Signal power between unit and sensor	Min. range: 4Vp-p Max. range: 400Vp-p
Mounting	1" BSP, 1" NPT
Transducer	50 kHz
Maximum sensor cable to unit distance	200 m (656 ft)

Electrical Specifications

Display	Customized LCD
Supply	18 to 30 VDC (0.25 A max) (external fuse: Slow Blow 1A T type*) **or** 100 — 230 VAC, 50/60Hz, 70mA Max.
Outputs	4-20 mA, 750 Ω load @ 24 VDC
Interface	RS-232 or RS-485
Protocol	Modbus — RTU**
Relays	5 independent SPDT

* Recommended type: 0034.3117 Schurter
** Consult factory for the user manual of Modbus

Certifications

CE - EMC,FMC, FM — Safety, FCC

Transmitter: FM, (Classified): Non Incendive, Class I,II,III/ Division 2/ Groups ABCDFG/T4

Sensor: EEx m IIC T5

Characteristics

Level, distance, flow, volume, kilograms, totalization and diameter.

Sensor Recommendations

25 kHz Sensor Recommendations

Material	Description
Coated aluminum (Halar®ECTFE)	Designed for complex environments with problematic echoes, such as non-conductive vapors, liquids and solids. Good performance in problematic applications. Usable in highly acidic or alcoholic environments. High sensitivity to echoes.

50 kHz Sensor Recommendations

Material	Description
Glass reinforced epoxy	For liquid and solid applications (not recommended for dusty environments.) High resistance in highly acidic and alcoholic environments. Used for rapid response.
PVDF	Chimically aggressive targets

Sensor Cable Lengths

All sensors are supplied with either pre cut cable or with flexible cable.
Sensor cable specifications: 4 wires, 0.75 mm^2 overall shielded, **compatible with HELUKABEL P.N.16028 (www.helukabel.de).**

NOTE:

It is recommended to use a connector when cutting/adding sensor cables (both precut and flexible sensors.)

For unclassified sensors use **BULGIN MINI BUCCANEER®** connector (P/N PX0800/1 or Solid AT' P/N ACC-I).

Pre cut cable (Non Hazardous)

Pre cut sensor cables can be modified to fit longer and shorten length than the one that was ordered. For example, if you ordered a sensor for the SmartScan 25 with a 5m/16.4ft cable, you will be able to modify it to a range between 5m/16.4ft to 50m/164ft, or if you ordered a sensor for the SmartScan 50 with 35m/114ft cable you will be able to modify it to fit a range between 5m/16.4ft to 100m/328ft. The modifications in the cable length can be made according to following tables:

NOTE:

Sensor cable should not be cut below minimum of 5 meters (16.4 ft) length.

For EX sensors, use fixed length cables only.

25 kHz Sensor Cable (CE)

25KHz sensor pre cut cable length (m/ft)	Can be changed to a range of (m/ft)
5m/16.4ft	5m/16.4ft to 50m/164ft
15m/49.21ft	5m/16.4ft to 50m/164ft
25m/82ft	5m/16.4ft to 50m/164ft
35m/114ft	5m/16.4ft to 50m/164ft
50m/164ft	5m/16.4ft to 50m/164ft
75m/246ft	50m/164ft to 100m/328ft
100m/328ft	50m/164ft to 100m/328ft
125m/410ft	100m/328ft to 150m/492ft
150m/492ft	100m/328ft to 150m/492ft
175m/574ft	150m/492ft to 200m/656ft
200m/656ft	150m/492ft to 200m/656ft

50 kHz Sensor Cable (CE + EEx m)

50KHz sensor pre cut cable length (m/ft)	Can be changed to a range of (m/ft)
5m/16.4ft	5m/16.4ft to 100m/328ft
15m/49.21ft	5m/16.4ft to 100m/328ft
25m/82ft	5m/16.4ft to 100m/328ft
35m/114ft	5m/16.4ft to 100m/328ft
50m/164ft	5m/16.4ft to 100m/328ft
75m/246ft	5m/16.4ft to 100m/328ft
100m/328ft	5m/16.4ft to 100m/328ft
125m/410ft	100m/328ft to 200m/656ft
150m/492ft	100m/328ft to 200m/656ft
175m/574ft	100m/328ft to 200m/656ft
200m/656ft	100m/328ft to 200m/656ft

Flexible cable

Flexible sensor cables are supplied with 5m/16.4ft loose-end cable. However, they can be modified to fit longer length than 5m/16.4ft. The modifications in the cable length can be made according to following tables (Shown on Appendix C, page 127):

25 kHz Sensor Cable

25KHz sensor cable length (m/ft)
5-50m / 16.4-164ft
50-100m / 49.21-328ft
100-150m / 328-492ft
150-200m / 492-656ft

50 kHz Sensor Cable

Can be changed to a range of (m/ft)
5m/16.4ft to 100m/328ft
100m/328ft to 200m/656ft

NOTE:

Any cable length beyond 100m/328ft, may reduce the measuring range.

Fixed cable length for EX Units

25 kHz Sensor

Fixed Cable Length (m/ft)
25m/82ft
50m/164ft
75m/246ft
100m/328ft

Chapter 2

Installing SmartScan

Precautions

- Ensure that the SmartScan components are mounted in an area that meets the stated temperature, pressure and technical specifications.
- Ensure that high-voltage sources or cables are at least 1 m/3.28ft away from the sensor and its cable.
- Use round cables with minimum diameter of 6-7 mm to ensure that the unit remains sealed (IP65/67).
- Ensure that cables are routed correctly and tightened along walls or pipes.
- Ensure that all cables are overall shielded (sensor cable, interface cable, power cable and current cable).
- Installation and operation of this product should be performed, according to the Product User Manual and Product Certification. Otherwise the use of this product is prohibited.

Installing the SmartScan Sensor

The following procedures describe sensor installation using 1" or 2" threading and a correlating locking nut. The installation procedure is the same whether the sensor is mounted directly on the tank or mounted on a pipe.

NOTE:

If applicable, you can also install the sensor by screwing it directly into the tank or pipe threading. Ensure that the tank/pipe threading matches the sensor threads.

➢ To install the sensor using 1" threading:

1. Open the required tank (or pipe).
2. Feed the free end of the sensor cable from the inside of the tank through the aperture at the top of the tank, until the sensor is pulled taut against the ceiling. The threaded end of the sensor should protrude from the top of the tank.
3. Spread silicon grease around the threading to seal against leakage (you can also use a Teflon band).
4. Thread the free end of the sensor cable through a 1" locking nut (not supplied with the SmartScan unit). Bolt the sensor into place by securing the nut to the sensor thread protruding from the top of the tank.

NOTE:

Tighten the nut by hand only. When tightening the nut, hold the lower part of the sensor.

5. Wire the sensor cable to the main SmartScan unit, as described on page 29.

➢ **To install the sensor using 2" threading (25 kHz standard range sensor):**

✦ Follow the procedure described on the previous page for 1" threading, using a 2" locking nut with the 2" BSP/NPT sensor threading.

Threading Options

SmartScan sensors are available in BSP or NPT thread types.
The 50 kHz sensor can be installed using 1" threading.
The 25 kHz sensors can be installed using 1" or 2" threading.
(Refer to *Figure 2: SmartScan Sensor Dimensions* in *Chapter 1, Introducing SmartScan*.)

1" BSP/1" NPT Threading for 25 kHz Sensor (Standard Range)

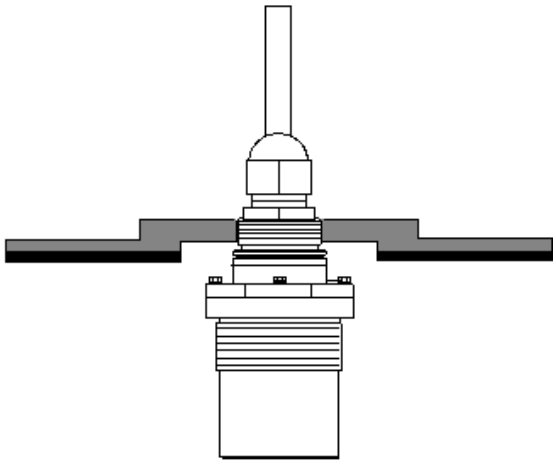
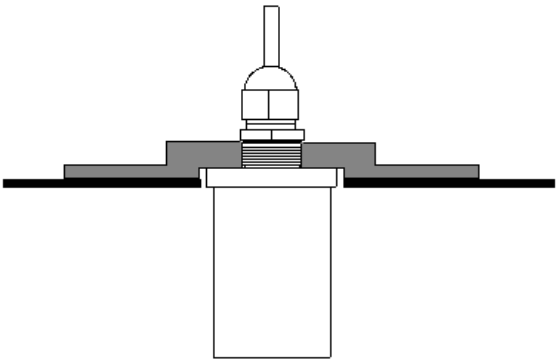


Figure 8: Sensor Threading Options

1" BSP/1" NPT
Threading for
50 kHz Sensor



1" BSP/1" NPT
Threading for
25 kHz Sensor
(Long Range)

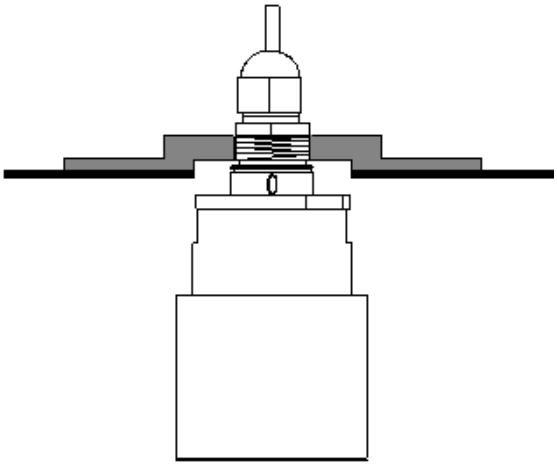


Figure 8 (Cont.): Sensor Threading Options

2" BSP/2" NPT Threading for 25 kHz Sensor (Standard Range)

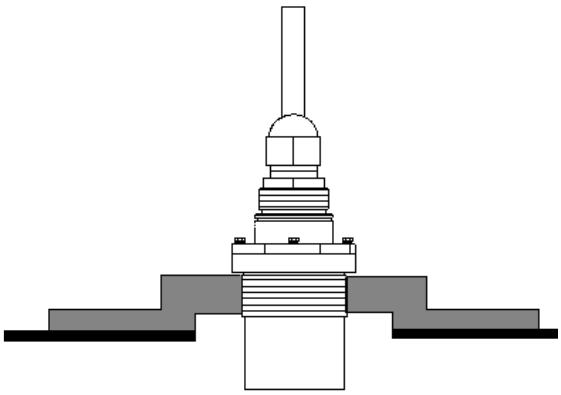


Figure 8 (Cont.): Sensor Threading Options

NOTES:

When installing a thread-free flange mounted unit, you will need a 1" or 2" locking nut (depending on the thread type used) to secure the sensor to the tank. The nut can be purchased separately.

When installing a threaded flange, ensure that it matches the SmartScan threads.

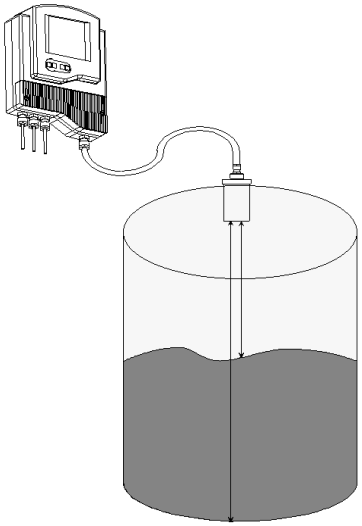
Sensor Positioning

When installing the sensor, ensure that it is:

- Mounted above the dead-zone area (blocking distance).

NOTE:

If the device enters the dead zone, it will not measure correctly.



- Positioned at least 0.5 m (1.64 ft) away from the tank walls.

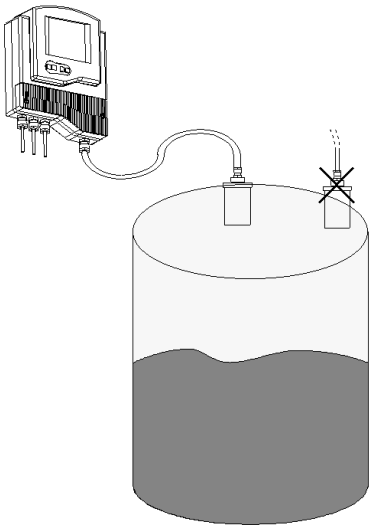
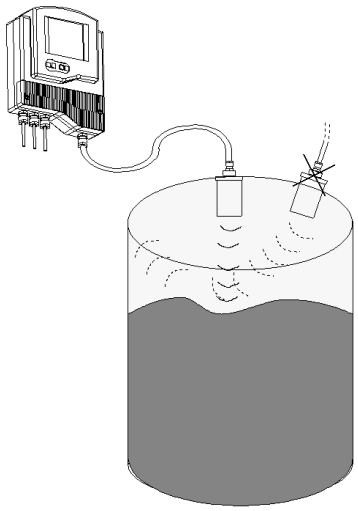


Figure 9: Sensor Positioning

- Perpendicular to the surface of the target.

NOTE:

A tilt in the angle may affect the echo quality



- Install the sensor as far as possible from noisy areas, such as a filling inlet.

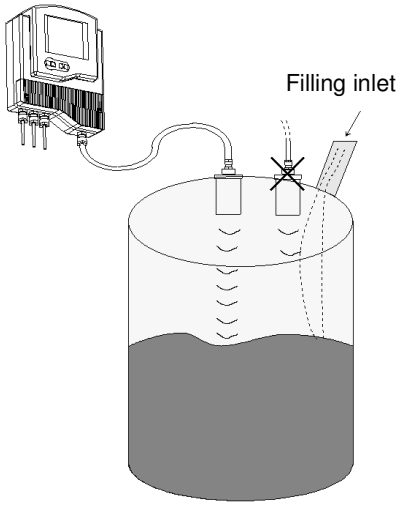


Figure 9 (Cont.): Sensor Positioning

Installing the Sensor via an Extension Pipe

If the level of the measured surface falls within the dead-zone area, you should use an extension pipe to mount the sensor.

When using an extension pipe, ensure that:

- The sensor is positioned in the center of the pipe.
- The pipe extension is parallel to the side/tank walls.
- The tank should be empty to allow tracking of false echoes.
- The internal pipe diameter is at least 3" wide.

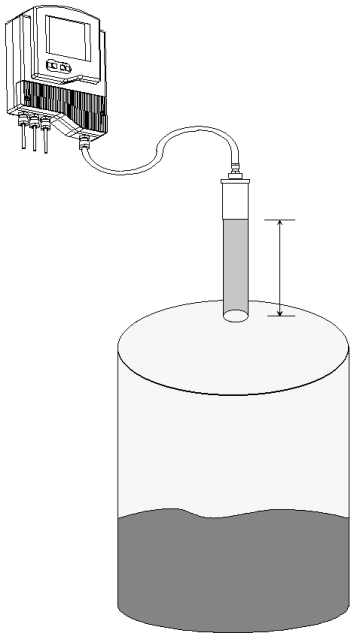


Figure 10: Extension Pipe Installation

When installing the sensor with an extension pipe, follow these specifications:

25 kHz and 50 kHz Sensor

Pipe Length	Internal Pipe Diameter
0.50 m (1.64 ft)	≥3"

NOTES:

We advise you to consult with your local distributor prior to the installation.

It is essential to run scan distance function during the installation process.

It is recommended to use pipes made of PVC/Plastic and not Stainless Steel.

When installing via extension pipe, it is recommended to keep approx. 5cm (2") gap between the shortest distance to target (maximal level) and sensor face. Set the SBD length to a value that is 5cm (2") smaller than the distance from the sensor face to pipe's lower edge, in order to avoid second harmony interference. See the specific SBD settings in the quick reference guide of each of the Smart model.

Wiring the SmartScan Unit

The lower part of the SmartScan unit consists of the electrical unit, which contains the wiring terminals for the sensor cable and the power cable. The electrical unit also contains optional connectors for monitoring of digital and analog outputs, as well as five optional relay connectors.

NOTE:

Remove the rubber sealing from the gland before wiring the connectors.

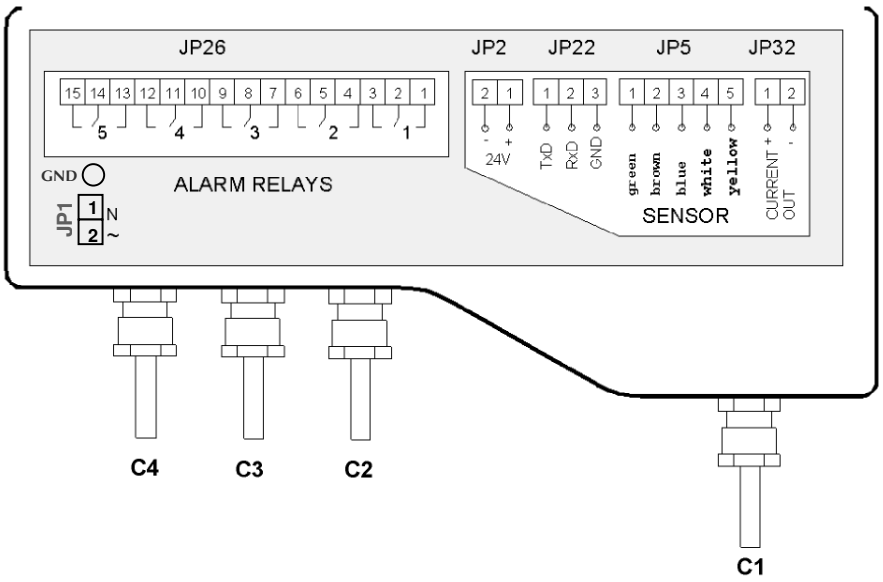


Figure 11: Electrical Unit using glands/conduits

In order to make a wiring connection, remove the ribbed faceplate covering the electrical unit using a 3-mm Allen wrench. Ensure that the cover is replaced securely after all wiring connections are completed.

➢ **To wire and install the SmartScan:**

1. Install the sensor, as described in Installing the SmartScan Sensor, page 20.
2. Route the sensor's cable (C1) from the sensor to the main unit location. Choose a route without electromagnetic interference (electrical engines, pumps or high voltage
3. Wire the sensor's cable (C1) to the main unit, as described in Wiring for the Sensor Cable, below.
4. Make any optional monitoring or relay cable connections to the main unit, as described on pages 31 and 32.
5. Connect the power cable to the main unit, as described on page 33.
6. If required, mount the main unit on the wall using the optional wall-mount plate.

Wiring the Sensor Cable

Sensor cable specifications: 4 wires, 0.75 mm^2 overall shielded, and compatible to HELUKABEL P.N.16028.

After the sensor is installed on the tank, the free end of the sensor cable is connected to the electrical unit using terminal JP5.

➢ To wire the sensor cable to JP5:

NOTE:

Ensure that the power is switched off before wiring the sensor cable.

7 Thread the sensor cable through aperture (C1), located on the right side of the SmartScan electrical unit's base.

8 Connect each colored wire in the cable to the appropriate screw-down termination post at terminal JP5, according to the color coding given in the table below (if the extension cable wires are black, follow the coding given in brackets).

JP5 Post	Color
1	Green (Black 1)
2	Brown (Black 2)
3	Blue
4	White (Black 3)
5	Yellow

NOTES:

Close the glands to ensure sealing.

Do not exceed 250-inch pounds torque on installation of conduit.

The O-ring is suitable for one use only.

Wiring the Monitoring Cables

SmartScan data can be monitored on a PC via an RS-485 or RS-232 connection to terminal JP22. You can also connect SmartScan to an analog output meter, set between 4 mA and 20 mA, using terminal JP32. (Setting the 4 mA and 20 mA values is described in *Chapter 3, Basic Setup*.)

➢ To wire the digital interface cable to JP22:

1 Thread the required cable through the wiring apertures (C2) located at the base of the electrical unit.

2 Connect each wire in the cable to the appropriate screw-down termination post at terminal JP22, wiring for RS-485 or RS-232, as required:

RS-485		RS-232	
JP22 Post	**Wire**	**JP22 Post**	**Wire**
1	B	1	TxD
2	A	2	RxD
3	Ground	3	Ground

➢ To wire the 4-20 mA cable to JP32:

1 Thread the required cable through the wiring apertures located at the base of the electrical unit.

2 Connect the wires in the cable to the screw-down termination posts at terminal JP32. Connect the positive wire to post 1 and the negative wire to post 2.

NOTES:

Close all glands to ensure sealing.

Do not exceed 250-inch pounds torque on installation of conduit.

The O-ring is suitable for one use only.

Wiring the Relays Cable

SmartScan's electrical unit provides connectors at terminal JP26 for up to five independently programmable relays. The relays can be used to initiate certain actions, such as controlling pumps, triggering an alarm or sending a warning message, when a defined value is reached. (Defining values for the relays is described in *Chapter 3, Basic Setup*.)

➢ To wire the relays cable to JP26 using VDC power:

1. Thread the required cable through apertures (C2/C3) located at the base of the electrical unit.
2. Connect the relay cable wires to the appropriate posts, as shown in Figure 11: Electrical Unit, page 28.

➢ To wire the relays cable to JP26 using VAC power:

1. Thread the required cable through apertures (C3/C4) located at the base of the electrical unit.
2. Connect the relay cable wires to the appropriate posts, as shown in Figure 11: Electrical Unit, page 28.

NOTES:

Close the glands to ensure sealing. The O-ring is suitable for one use only.
If your unit is equipped with conduits instead of glands, aperture C3 is not available. Use aperture C4 instead.

Do not exceed 250-inch pounds torque on installation of conduit.

Wiring the VDC Power Cable

The free end of SmartScan's power cable is connected to the electrical unit using terminal JP2 when working in VDC.

➢ **To wire the power cable to JP2:**

1. Thread the required cable through C2 aperture at the base of the electrical unit.
2. Connect the wires in the cable to the appropriate screw-down termination posts at terminal JP2. Connect the negative wire to post 2 and the positive wire to post 1.

Wiring the VAC Power Cable

The free end of SmartScan's power cable is connected to the electrical unit using terminal JP1 when working in VAC.

➢ **To wire the power cable to JP1:**

1. Thread the required cable through C4 aperture at the base of the electrical unit.
2. Connect the wires in the cable to the appropriate screw-down termination posts at terminal JP1. Connect the zero wire to post 1 and the phase wire to post 2.

CAUTION! HIGH VOLATGE IN JP1!

NOTES:

Close all glands to ensure sealing. The O-ring is suitable for one use only.

SmartScan 25 Unit - Intrinsically Safe Connections

Hazardous Area Installation

(For Ex version)

Installation of the equipment shall be in accordance with the NEC Articles 504 and 505 and ISA RP 12.06.01 Recommended Practice for the Installation of Intrinsically Safe Circuits.

Instructions specific to hazardous area installation.

(Reference European ATEX Directive 94/9/EC, Annex II, 1.0.6.)

The following instructions apply to equipment covered by certificate number Sira 03ATEX2518X:

- The equipment may be used in a hazardous area with flammable gases and vapors with apparatus groups IIC, IIB and IIA and with temperature classes T1, T2, T3, T4.
- The equipment is certified for use in ambient temperatures in the range of -40oC to +70oC and should not be used outside this range.
- Installation shall be carried out in accordance with the applicable code of practice by suitably trained personnel.
- The equipment is not intended to be repaired by the user. Repair of this equipment shall be carried out by the manufacturer in accordance with the applicable code of practice.
- If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from

being adversely affected, thus ensuring that the type of protection is not compromised.

- The certificate number has an 'X' suffix that indicates that the following special condition of certification applies;
- The supplies from the two intrinsically safe barriers must be prevented from combining with each other in the supply cable by using separate cables or a cable with a screen around each circuit.
- Aggressive Substances - e.g. acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.
- Suitable Precautions - e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.
- The manufacturer should note that, on being put into service, the equipment must be accompanied by a translation of the instructions in the language or languages of the country in which the equipment is to be used and by the instructions in the original language.
- The instructions shall contain the certification marking as detailed on the relevant certification drawing; number DD-SN25Ex-labels.

SPECIAL CONDITIONS FOR SAFE USE

Equipment intended for use in Potentially Explosive Atmospheres Directive 94/9/EC

The following instructions apply to equipment covered by certificate number:Sira 04ATEX5339X

Ultrasonic Sensor 25Khz & 50Khz.

- The 'X' suffix to the certificate number relates to the following special conditions for safe use:
- The sensors shall not be located in direct sunlight or light from luminaires.
- The encapsulated Type 'm' sensors in the series shall be supplied from apparatus that provides protection against prospective short circuit currents of up to 1500 A or appropriate to the supply prospective current.
- Under certain extreme circumstances, the non-metallic enclosures of this equipment may Generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be used in a location where the external conditions are conductive to the build-up of electrostatic charge on such surfaces. Additionally, the equipment shall only be cleaned with a damp cloth.

Wiring the Sensor Cable to the Barriers (for IS only)

SmartScan 25 sensor cable should be connected to Zener barriers (refer to the barriers' specifications detailed on page 37), to prevent high voltage bursts and to protect the unit from damage. Before wiring the cable to the unit ensure that the power supply connected to the SmartScan unit, is switched off.
Two barriers should be connected; one to the transducer and the other to the temperature sensor. First wire the sensor cable' loose end to the barriers' termination posts 3 and 4 (maximum cable length to be used is 75m/246ft). Then wire the barriers termination posts 1 and 2 to terminal JP5 in the SmartScan electrical unit using an additional sensor cable (maximum cable length to be used is 25m/82ft).

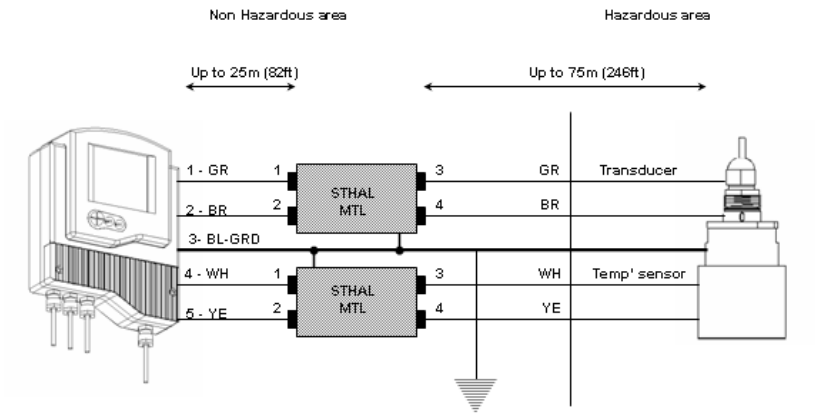


Figure 11a: Intrinsically Safe Connections

NOTE:

The complete control drawing can be downloaded from our web site at: www.solidAT.com/FAQ/Products/SmartScan25

Wiring the Transducer to the Barriers

➢ **To wire the sensor cable to the transducer barrier:**

1. Screw-down the sensor's green (GR) wire to the barrier's termination post (3).
2. Screw-down the sensor's brown (BR) wire to the barrier's termination post (4).

➢ **To wire the sensor cable to the temperature sensor barrier:**

1. Screw-down the sensor's white (WH) wire to the barrier's termination post (3).
2. Screw-down the sensor's yellow (YE) wire to the barrier's termination post (4).

NOTE:

The sensor's blue (BL) wire is for ground purposes and should be attached to the barrier's chassis.

Wiring the Barriers to the SmartScan Unit

➢ **To wire the transducer barrier to terminal JP5 in the SmartScan unit:**

1. Screw-down the sensor's green (GR) wire (1) first end to the barrier's termination post (1) and the other end to terminal JP5 termination post (1).
2. Screw-down the sensor's brown (BR) wire (2) first end to the barrier's termination post (2) and the other end to terminal JP5 termination post (2).

➢ To wire the temperature barrier to terminal JP5 in the SmartScan unit:

Thread the sensor cable through aperture (C1), located on the right side of the SmartScan electrical unit's base.

1. Screw-down the sensor's white (WH) wire (4) first end to the barrier's termination post (1) and the other end to terminal JP5 termination post (4).
2. Screw-down the sensor's yellow (YE) wire (5) first end to the barrier's termination post (2) and the other end to JP5 termination post (5).

NOTES:

Ensure that the SmartScan unit power is switched off before wiring the sensor cable or any other cable to the unit.

The sensor's blue (BL) wire is used for ground purposes and should be screwed-down to terminal JP5 termination post (3).

Sensor cable specifications: 4 wires, 0.75 mm2 overall shielded, and compatible to HELUKABLE P.N.16028.

It is highly recommended to use a linear or surge power supply as your power supply.

Do not exceed 250-inch pounds torque on installation of conduit.

When using glands make sure that these glands are FM approved for the specific Class and Division of your installation.

WARNING!

Electrostatic hazard. The sensor should be cleaned with a damp cloth only!

Barriers Specifications

Transducer Circuit Barriers

Producer	Zener Barrier Part Number	Intrinsic Safety Approval	Interconnection	
			Barrier Terminal	SmartScan Terminal
MTL	7778ac	CSA, ATEX, FM, UL	3 4	1 2
STAHL	9002/77-280-094-00	CSA, ATEX, FM, UL	3 4	1 2

Temperature Sensor Circuit Barriers

Producer	Zener Barrier Part Number	Intrinsic Safety Approval	Interconnection	
			Barrier Terminal	SmartScan Terminal
MTL	7755ac or 755	CSA, ATEX, FM, UL	3 4	1 2
STAHL	9001/01-050-150-10	CSA, ATEX, FM, UL	3 4	1 2

Chapter 3

Basic Setup

This chapter describes how to set up and calibrate SmartScan for accurate measurement monitoring using the basic menu options.

SmartScan is supplied with preprogrammed default settings, making it ready for immediate operation. Measurement readings are displayed on the default screen as soon as the unit is powered on, as described in *Default Screen*, page 48.

It is recommended that you replace the default tank height value with the actual tank height, as described in *Setting the Tank Height*, page 68. When using SmartScan, the tank height is calculated as the distance from the surface of the sensor to the bottom of the tank. You should enter this value whenever tank height is required. (For flow measurement, enter the precise flume height.)

The SmartScan main menu (shown on page 42) enables you to access the primary functions for SmartScan operation, so that you can change the default settings and calibrate SmartScan, as required. You can define further specialized function options for SmartScan from the additional menu, as described in *Chapter 5, Additional Features*.

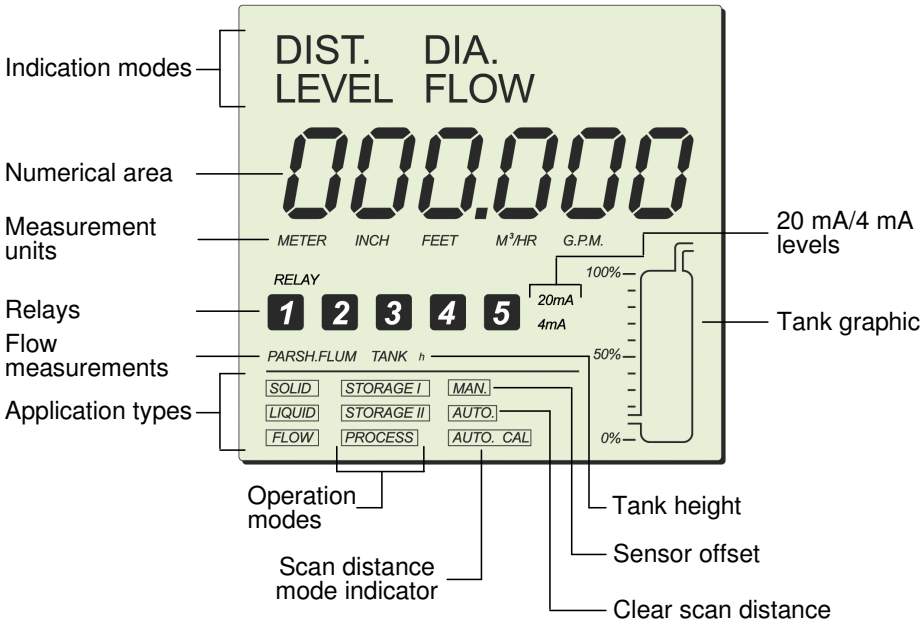


Figure 12: SmartScan Main Menu Screen

NOTE:

The options displayed in the main menu depend on the SmartScan model so you may not necessarily view all the options shown in the above example.

Using the SmartScan Function Buttons

The function buttons are used to perform various operations, summarized in the following table.

Button	Uses Include:
ENT.	✦ Accessing the menus (when pressed simultaneously with ESC.). ✦ Accessing a function within a menu, enabling you to make modifications. ✦ Moving from left to right between displayed digits in the numerical area (refer to *Modifying Numerical Values*, page 44). ✦ Saving changes to data.
ESC.	✦ Accessing the menus (when pressed simultaneously with ENT.). ✦ Moving from right to left between displayed digits in the numerical area (refer to *Modifying Numerical Values*, page 44). ✦ Taking you back to the previous function step (without saving changes), or back to the default screen.
BACK or NEXT	✦ Moving to the next/previous function within a menu. ✦ Scrolling through available data/numerical values within functions. ✦ **NEXT** button only: Saving interfering signals (For more details, see page 74).

Modifying Numerical Values

Within some functions, the value displayed in the numerical area can be modified. The digit currently available for modification is displayed flashing (flashing digits are shown in gray in the illustrations, for example,). The value is modified by using the ENT. and ESC. buttons to move between the digits, and by using the BACK and NEXT buttons to scroll through the possible number values for the flashing digit. If you press ESC. on the far-left digit, you will revert either to the previous step of the function or to the main menu, without saving. If you press ENT. on the far-right digit, the new value is saved.

Menu and Version Selection

SmartScan has two menus, the main menu and the additional menu. To access each of these, you must select the appropriate digit in the numerical area of the display screen. After selecting the required digit (by pressing the **ENT** button), the corresponding number icon flashes in the LCD, indicating that SmartScan is entering the selected version mode or menu.

Digit	Number Icon	Version Mode/Menu Option
1	1	Option to enter setup mode
3	3	Option to enter the main menu
4	4	Option to enter the additional menu

The complete procedure for accessing each version mode or menu is described in the relevant chapters of this manual.

NOTE:

The number icons also have other functions in SmartScan. These include identifying the active relay(s) for the relay function in the unit.

Accessing the Main Menu

This chapter describes access and setup for SmartScan 25 and 50.

The SmartScan main menu screen (shown on page 42) is accessed from the default screen, using the function buttons located under the LCD.

➢ **To access the main menu:**

	Press/Action	Display	Explanation
⇨	Press ENT. and ESC. simultaneously.	C0-000	Displays the password window.
⇨	ENT. or ESC. BACK or NEXT		Use to enter the password code (**716**) in place of the last three digits (**000**). (Function button use is described on page 43.)
⇨	ENT.	1	Required option to enter setup mode.

	Press/Action	Display	Explanation
⇨	ENT.	1 flashes for approximately 5 seconds, then 3 is displayed.	Required option to access the main menu.
⇨	ENT.	3 flashes for approximately 5 seconds, then the main menu screen is displayed.	A representation of the main menu screen is shown on page 42.

NOTE:
You can return to the default screen by pressing the **ESC** button.

Using the Main Menu

The **BACK** and **NEXT** buttons are used to move through the various main menu options, with the current option indicated by a flashing display. You can access and modify the main menu functions in any order, but you should remember that a change to the data for one function might affect the data for another function. For example, changing the tank height value will also change the default value for **20 mA**. There are permitted minimum and maximum values for many of the functions; refer to *Appendix A, SmartScan Ranges*.

The level of the tank graphic displayed in the main menu screen moves up from 0 to 100% when you save an option or when SmartScan is processing. After saving an option, the main menu is displayed with the next option flashing.

Default Screen

As soon as SmartScan is fully installed and powered on, the LCD displays the default screen. The default screen provides continuously updated measurement readings and displays the current settings for some functions (either the default settings or the settings selected from the main menu). The relay number is displayed for each activated relay. You can toggle between display indication types, such as: level, distance, volume and others, by using the SmartScan function buttons (SmartScan 50 SW ver.5.06 onwards.) For more details, see page 52.

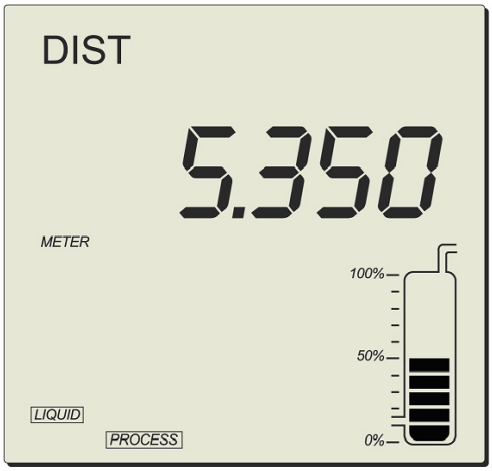


Figure 13: SmartScan Default Screen

The tank graphic in the default screen gives an approximate visual indication of the current level of the tank contents, while the numerical area gives the exact reading. If the level enters the dead zone, the numerical area displays FF FFF; if the tank is empty, the numerical area displays the tank height. 000.000 may be displayed temporarily while SmartScan is taking a reading.

You can refresh the reading by pressing the **ENT** and **BACK** buttons simultaneously.

NOTE:

By default, the displayed value is in meters, and gives the distance measurement, meaning from the sensor to the level of the liquid/solid. The measurement indication mode and measurement unit can be changed, as described in *Setting the Indication Mode*, page 51, and Setting the Measurement Unit, page 53.

Setting Main Menu Options

The following functions are available in the SmartScan main menu.

Setting the Indication Mode	Refer to page 51.
Setting the Measurement Unit	Refer to page 53.
Setting the Relay Values	Refer to page 55.
Setting the 20 mA/4 mA Levels	Refer to page 66.
Setting the Flow Measurements	Refer to page 67.
Setting the Tank Height	Refer to page 68.
Setting the Application Type	Refer to page 70.
Setting the Operation Modes	Refer to page 71.
Setting the Scan Distance Values	Refer to page 74.
Clearing the Scan Distance Values	Refer to page 77

NOTES:

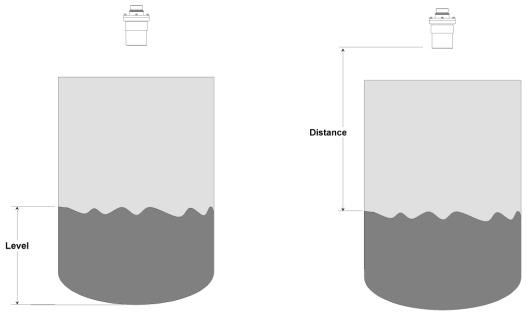
Some functions are only relevant for particular SmartScan models.

You can leave the main menu and return to the default screen by pressing the **ESC** button.

Setting the Indication Mode

The first function in the main menu is the indication mode. The following indication options are available, depending on the SmartScan model**:**

- **DIST:** (Default setting) The displayed reading represents the distance from the sensor to the surface of the tank contents.
- **DIA:** The displayed reading represents the diameter of the measured material.
- **LEVEL:** The displayed reading represents the level of the contents, measured from the bottom of the tank.



- **FLOW:** The screen displays temporary flow passing through the configured flume/weir. If required, you can select this option to label the reading, when working in flow mode.

Setting an indication mode enables you to toggle between other indications types as well, using **BACK** or **NEXT** buttons, as described in the table below*:

* Toggling between indication types is available in SmartScan 50 only.

Indication	Indication Toggle Option
Distance/Level	Distance/Level
Flow	**Flow**/Level/Distance/ Totalization (High)/Totalization (Low)
Totalization	**Totalization/**Distance/Flow
Volume	**Volume**/Level/Distance

➢ **To set the indication mode:**

	Press/Action	Display	Explanation
⇨	BACK and NEXT	DIST. DIA. LEVEL FLOW	Use to move between the available options.
⇨	Press ENT. to save the selected option.	For example, LEVEL	Displays the selected option for a few seconds and then redisplays the main menu.

For example, if the unit is configured for flow, you can toggle between flow/level/distance indications using the **NEXT** button.

Setting the Measurement Unit

SmartScan enables you to set the measurement unit used for the displayed readings, according to your requirements and the measurement function. The following measurement options are available:

- **METER** (default unit), **INCH** or **FEET:** Select one of these options for distance measurements.
- **M^3/HR** or **G.P.M.:** Select one of these options for flow measurements.

After setting the measurement unit, the selected unit flashes on the display whenever you enter numerical values during the setup procedure. The values for functions such as relay will be displayed in the selected measurement unit.

➢ **To set the measurement unit:**

	Press/Action	Display	Explanation
⇨	BACK and NEXT	METER INCH FEET M^3/HR G.P.M.	Use to move between the available options.
⇨	Press ENT. to save the selected option.	For example, FEET	Displays the selected option for a few seconds and then redisplays the main menu.

NOTE:

If you select **METER**, any relevant flow measurements will be in metric units, meaning **M^3/HR**. The opposite also applies, so that if you select **M^3/HR**, any relevant distance or level measurements will be in meters. If you select **INCH** or **FEET**, any relevant flow measurements will be in **G.P.M.** If you select **G.P.M.**, any relevant distance or level measurements will be in inches.

In case you select **METER** when using a FLOW model configured to show **G.P.M**, the **METER** sign will flash rapidly for few seconds. If you approve the selection by pressing ENT. the flow measurement units will be in **M^3**. If else, the measurement units will stay in **G.P.M** and vise versa. (this is applicable for SmartScan 50 models, SW 5.06 onwards only).

Setting the SmartScan 50 Relay Values

You can set the relays to five different configuration modes: **Level**, **Distance** and **Flow (**where applicable**)**, **Volume** and **Totalization (**the last two modes should be configured only after Volume/Totalization options were enabled in the *Chapter 5, Additional Features*). Use **NEXT** or **BACK** buttons to toggle between modes and **ENT.** to select the mode. After selecting an indication mode, move on to set the first relay parameters.

	Non Flow Application			**Flow Application**	
Indication Mode	Dist.	Level	Vol.	Flow	Total.
Relay Mode	Dist., Level		Vol.	Flow, Dist., Level	Flow, Total.

Relays Setup Options

For example, if the SmartScan is set to flow indication mode the relay can be set to flow/distance or level values. In any other unit or SW version, the relay configuration is done for level or volume values.

Each of the five relays in the SmartScan allows you to define open and close values for the switch, enabling its use for functions such as triggering an alarm or controlling pumps.

In addition, relay four (4) can be configured to report error messages and relay five (5) for flow totalization pulse setup (see detailed configuration instructions on pages 62, 63).

The relay values function as follows:

- **Open value:** (Default = 0) The relay opens if the level measured in the tank is higher than the entered open value.

- **Close value:** (Default = 0) The relay closes if the level measured in the tank is lower than the entered close value.

NOTES:

The indication mode default state is **Level**. The chosen mode will be applicable for all five relays.

The close value must be lower than the open value for each relay, otherwise an Err. 3 message is displayed.

An Err. 7 message is displayed if a relay value is greater than the tank height value.

In case of no measurement (caused by electronic problem or acoustic interference) relays will switch to Close state.

For safety reasons relays parameters will reset when the following parameters will be modified: Tank height, relays indication mode (Level/ Distance/Flow), measurement mode (except when changing from Level to Distance and vise versa) Flume/Weir type, measurement units, strapping table

➢ **To set the relay values for level or distance:**

	Press/Action	Display	Explanation
⇨	ENT. to enter relay setup.	RELAY	With the **RELAY** icon flashing.
⇨	ENT. to assign an indication mode for the relays.	dISt LEUEL	Choose the desired relay configuration mode: **Level**, **Distance**, **Flow**, **Totalization** or **volume**. Use the **NEXT** button to toggle between indication modes and **ENT**. to select the mode.
⇨	ENT. to enter open mode.	OPE.n and 1	Enters the open values mode of the relay setup. The appropriate relay number flashes throughout the process of defining values for that relay.
⇨	ENT. or ESC. BACK NEXT or	000.000	Displays 0 or the previously entered relay value.

	Press/Action	Display	Explanation
⇨	ENT. to enter values for the relay.	002.000	Use to enter the relay value.
⇨	Press ENT. at the end of entering a value for relay 1, to enter close value parameters.	CLO.SE and 1	Enters close values mode of the relay setup. Enter and save the close values in the same way as described above for the open values.
⇨	Press ENT. on the far-right digit to save the value.	OPE.n and 2	Repeat the previous steps to set an open/close values for each relay to be used. (If you do not want to set a value for every relay, use the **Esc** button to exit the relays set-up mode.)

NOTE:

In DISTANCE mode, the **OPEN** value entered for a relay should be greater than the **CLOSE** value entered for the relay otherwise an Err. 10 is displayed.

Relay **OPEN** and **CLOSE** values in DISTANCE mode, should be different by a resolution of more than 3cm.

Relays values can be configured in two separate screens when set to flow, volume or totalization (after setting the SmartScan was set to of these indications).

➢ **To set the relay values for flow:**

	Press/Action	Display	Explanation
⇨	ENT. to enter relay setup.	RELAY	With the **RELAY** icon flashing.
⇨	ENT. to assign an indication mode.	FLOuu	Choose FLOW from the optional modes, and press ENT.
⇨	BACK or NEXT	For example, 1 and OPE.n	Select the relay number you wish to configure, using NEXT and BACK buttons and press ENT. Select OPEN and press ENT.
⇨	ENT.	H00001	This screen allows you to enter up to four digits of High numbers of flow values.

	Press/Action	Display	Explanation
⇨	ENT.	For example, L20.000	Use this screen to enter Low numbers of up to five digits of flow values.
⇨	ENT.	CLO.SE	Enter relay values for Close mode, as described above for Open mode.

As shown in the above example, relay values were configured in the following way: 000001 was entered in the high numbers H=1 and 20,000 was entered in the low numbers L=20,000 which mean a total value of 120,000 gallons.

NOTE:

The same configuration applies when selecting volume mode for the relays.

Relays OPEN and CLOSE values should differ when working in **FLOW** or **TOTALIZATION** mode.

Setting relay 4 to report errors

This mode enables you to use the relay as a trigger to set on an alarm or siren in case the unit produces inaccurate measurement results due to an electrical failure or acoustic problem. You can configure relay 4 to report errors or to remain in normal set-up mode. Once the error mode is enabled and one of the situations described below will appear, the relay will be closed and an error message will show on the unit display. These error messages will describe the following situations:

- EE EEE - In case of lost echo or when measurement result is higher than tank height.
- FF FFF - Near dead zone.

The relay will remain in Open mode as long as the unit displays proper measurement values.

➢ **To set relay 4 for error report:**

	Press/Action	Display	Explanation
⇨	BACK or NEXT	OPE.n	Move to relay 4 using NEXT or BACK buttons and ENT. to enter the relay mode.
⇨	ENT.	Err En Err dS	Choose Err En to enable error alert or Err dS to disable.

Setting relay 5 for flow totalization pulse indication

You can choose to set relay number five (5) for flow totalization pulse indication or to remain in normal set-up mode. This option enables you to reserve the accumulated value gathered by the unit, by using an external counter. In this way the total value will be reserved even if the unit will be replaced. Once set for this option, the relay will generate a pulse per Xm^3 or Gallons of flow depend on the value that you have selected from the following list of optional values (you can define the X value): 1, 10, 100, 1000, 10000, 100000. An electrical pulse will be generated whenever the relay total flow value will be larger than the value selected from the list. You can also choose a pulse width between 20 to 2000 milliseconds with a resolution of 10 milliseconds to match your equipment requirements. For example, the relay will generate a pulse with a duration of 1000ms and each time the value of flow will reach 10,000 M^3 (provided that this value was selected from the optional list of values).

NOTE:

Prior to setting relay 5 for pulse indication, you should configure the SmartScan for Totalization (see Chapter 5, Additional Features).

To configure relay 4 and 5 to work in a normal setup, select Open or Close mode and enter the required parameters. When configure relay 5 as tOt En, the active options are tOt En and tOt dS. To go back to normal work press tOt dS.

The result of the totalization amount is updated every 30 seconds.

➢ **To set relay 5 for pulse indication:**

	Press/Action	Display	Explanation
⇨	ENT. or ESC. BACK or NEXT	OPE.n CLOSE	Move to relay 5 using NEXT or BACK buttons and ENT. to enter the desired operation mode.
⇨	ENT. to select enable or disable mode.	tOt En tOt dS	Choose tot En to enable pulse indication option or tot-ds to disable this option.
⇨	ENT. to select a pulse value from the list.	010 000 For example, 10,000m³.	Select a pulse value from the list of optional values using NEXT button and then ENT. to save your selection. Optional values are between 1 to 100,000.
⇨	ENT. to enter a pulse width value (as specified in your equipment).	PL1 000 For example, 1000ms.	Enter a pulse width value between 20 milliseconds and 2000 milliseconds (the resolution of 10 milliseconds).

Following the above configuration example, a pulse with duration of 1000ms will occur each time the total value of flow will reach 10,000m³.

Setting the SmartScan 25 Relay Values

You can set up to five relay switches for SmartScan 25. Each relay enables you to define open and close values for the switch, for functions such as triggering an alarm.

The relay values function as follows:

- **Open value:** (Default = 0) The relay opens if the level measured in the tank is higher than the entered open value.
- **Close value:** (Default = 0) The relay closes if the level measured in the tank is lower than the entered close value.

NOTES:

The close value must be lower than the open value for each relay, otherwise an Err. 3 message is displayed.

An Err. 7 message is displayed if a relay value is greater than the tank height value.

In case of no measurement (caused by electronic problem or acoustic interference) relays will switch to Close state.

For safety reasons relays parameters will reset when the following parameters will be modified: Tank height, relays indication mode (Level/ Distance/Flow), measurement mode (except when changing from Level to Distance and vise versa) Flume/Weir type, measurement units, strapping table

➢ **To set the relay values for level or distance:**

	Press/Action	Display	Explanation
⇨	ENT. to enter relay setup.	RELAY	With the **RELAY** icon flashing.
⇨	ENT. to enter open mode.	OPE.n and 1	Enters the open values mode of the relay setup. The relay number flashes throughout the process of defining its values.
⇨	ENT. or ESC. BACK or NEXT	000.000	Displays 0 or the previously entered relay value.
⇨	Press ENT. on the far-right digit to save the value.	OPE.n and 2	Repeat the previous steps to set an open/ close values for each relay to be used.

Setting the 20 mA/4 mA Levels

SmartScan enables you to set height, volume or flow values to be used as 20 mA and 4 mA marks. These values can be used for remote monitoring of tank level, volume or flow using an analog meter. The analog output indicates the current depth in the tank, or the current flow level, as a point on the meter range between 4 mA and 20 mA. The default value for 20 mA is the tank height (or the maximal volume value), and for 4 mA the default value is 0 (or the minimum volume value).

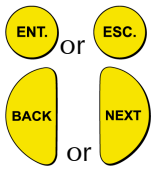
NOTES:

The values for 20 mA and 4 mA must be different, otherwise an Err. 4 message is displayed. Both must also be less than the tank height value, otherwise an Err. 7 message is displayed.

In both distance and level measurement modes, the dead-zone area affects the maximum values that can be used for 20 mA/4 mA levels. For SmartScan 25 models, the maximum 20 mA/4 mA value is tank height minus 0.6 m/1.9 ft. For SmartScan 50 models, the maximum 20 mA/4 mA value is tank height minus 0.4 m/1.3 ft.

➢ To set the 20 mA/4 mA levels:

	Press/Action	Display	Explanation
		20mA 4mA	With the required option flashing in the main menu.
⇨	Press ENT. to enter 20 mA or 4 mA setup.	000.000	Displays the default value or the previously entered 20 mA or 4 mA value.

	Press/Action	Display	Explanation
⇨			Use to enter the new value. (Function button use is described on page 43.)

The values of 4-20mA are application dependable. For example, when measuring distance the value will be in distance (same for level).

NOTE:

VOLUME values in 4-20mA are represented by six digits (the same applies for **FLOW** values). **TOTALIZATION** values are represented by large numbers and therefore require two separate screens for high (H) and low (L) numbers (as explained on pages 60, 61)

Setting the Flow Measurements

The **PARSH.FLUM** function enables you to set flume/weir types and measurements for SmartScan open channel models. Refer to *Chapter 4, SmartScan Open Channels,* for further information.

Setting the Tank Height

You can enter the height of your tank using the **TANK h** function. The default value is the maximum value in the relevant measurement range for your SmartScan model (refer to the range table in *Appendix A, SmartScan Ranges*). If you enter a value that exceeds this maximum value, an Err. 8 error message is displayed.

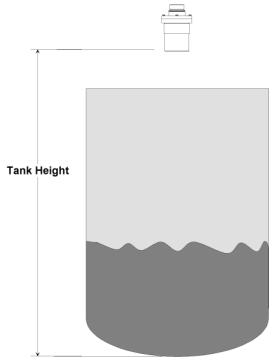


Figure 14: Tank height

Setting the tank height will not influence the measuring range, or the accuracy of the device, which is calculated from the measuring range. Refer to the specifications tables in *Chapter 1, Introducing SmartScan*.

NOTES:

Whenever the tank height is required, you should enter the distance from the surface of the sensor to the bottom of the tank. In order to obtain accurate measurement results it is most recommended to perform this operation when the tank is empty. For flow measurement, enter the precise flume height.

If the entered tank height value is less than a value previously entered for the **4 mA**, **20 mA** or **Relay** functions, the value for that function will automatically revert to the default value.

➢ **To set the tank height value:**

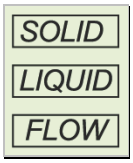
	Press/Action	Display	Explanation
⇨	BACK or NEXT	DIST. DIA. LEVEL FLOW	Select the desired measurement method from the indication modes: DIST, LEVEL, DIA. Using NEXT or BACK buttons.
⇨	ENT. to save the selected option.	DIST. for example.	Displays the selected option for a few seconds and a flashing tank graphic.
⇨	NEXT and ENT.	METER INCH FEET	Move on with the NEXT button to select measurement units: METER, INCH, FEET. Press ENT. to save your selection.
⇨	BACK or NEXT	TANK h	Move with NEXT or BACK button to **tank h**.
⇨	ENT.	For example 0 12000 meters.	Displays the last saved tank height or the default value.
⇨	ENT. or ESC.		Use to enter the new value.

Setting the Application Type

The SmartScan main menu displays (by default) **SOLID**, for models intended for solid applications, or **LIQUID** for models intended for liquid.

When SmartScan unit is configured as either **LIQUID** or **FLOW** (open channel) model, selecting **FLOW** option from the indication mode automatically selects the **FLOW** option in the application types menu. This should be done before entering values for other functions, so that all values are automatically adjusted for flow.

➢ **To set the application type:**

	Press/Action	Display	Explanation
⇨			With the required option flashing, depending on the type of model in use. (For example, if the model is intended for solid applications, then only the SOLID option will appear.)
⇨	ENT.	For example, For liquid models only.	Displays the selected option for a few seconds, and then redisplays the main menu.

Setting the Operation Modes

The operation modes function enables you to set SmartScan to compensate for environmental conditions that affect the measurement readings.

For solid and liquid applications, each mode determines the reaction time required for SmartScan to recalibrate when there is a change in the environmental conditions. Depending on the specific requirements for your application, you can select a solid or liquid mode that provides faster readings but with less precision (by performing a smaller number of calculations per cycle), or slower readings with a greater degree of accuracy (by performing a larger number of calculations per cycle).

The modes settings are defined by making a selection from the **STORAGE I**, **STORAGE II** and **PROCESS** options in the main menu, in some cases in combination with the selection of a particular application type (either **SOLID** or **LIQUID**). The mode functions and setup are described in the following sections.

NOTE:

The operation modes are not relevant for flow applications. If one of the **STORAGE I**, **STORAGE II** or **PROCESS** options is selected when SmartScan is in **FLOW** application mode, an Ar5. warning message is displayed and SmartScan reverts to distance mode. You must then reset the unit to flow mode.

Liquid Modes

Three modes are available for SmartScan liquid-application models. Each mode is recommended for use as follows:

- STORAGE I: Recommended in the following conditions:
  - Wavy surfaces
  - Slow filling/emptying rate
  - Applications where the sensor is installed near the tank wall
- STORAGE II: (Twice as fast as **STORAGE I**.) Recommended in the following conditions:
  - Reasonable surface conditions
  - Applications requiring fast readings

NOTE:

STORAGE I and **STORAGE II** liquid modes are not suitable for measuring surfaces with foam, since these modes cannot perform signal processing.

- PROCESS: This mode is suitable for applications where a fast reading is more important than precision. A reading will be displayed within a short time, even if the signal processing procedure was not completed.

  Recommended in the following conditions:
  - Foamy top surface
  - Presence of agitation
  - Presence of vapor
  - Applications requiring very fast readings

Solid Modes

Three modes are available for SmartScan solid-application models. The main difference between the modes is in the search process required to select the correct echo.

Each mode is recommended for use in the following conditions:

- STORAGE I and STORAGE II: Very dusty environments (such as cement)
- PROCESS: Grain applications

Setting the Scan Distance Values

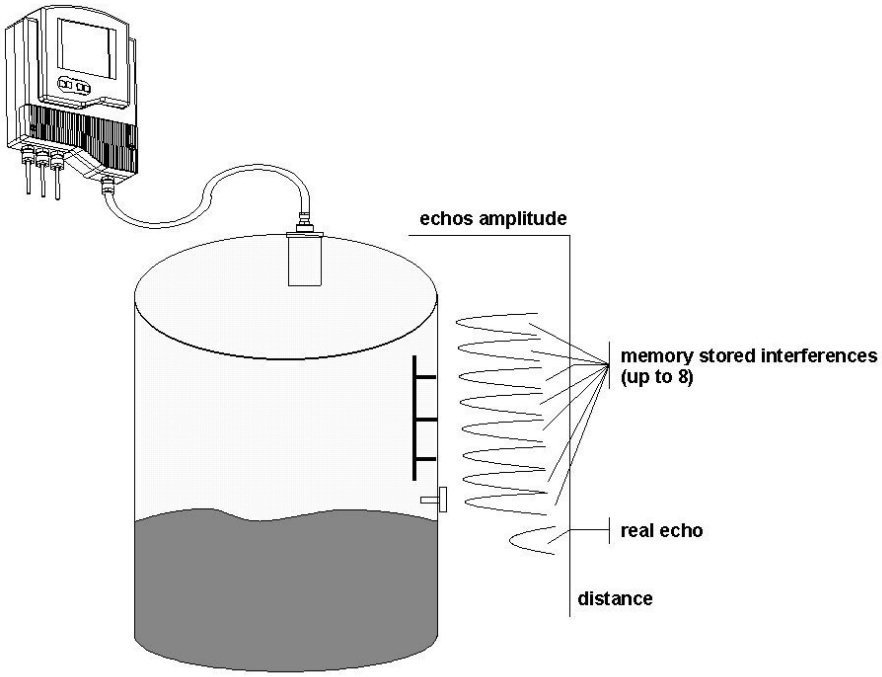


Figure 145: Scan Distance Process

Up to eight interfering signals (false echoes) can be located by SmartScan and stored in its memory. The false echoes, which may be caused by obstructions such as a tank agitator or a side wall, can generate false readings and so interfere with the true scanning of the tank contents. Defining interfering signals is done while the tank is empty.

Each scan distance reading is stored as an interfering signal until a reading is achieved that indicates the true echo. If eight interfering signals are already stored and a ninth reading is received, the first value stored is deleted and the new one saved.

The scan distance function is accessed from the default screen. **AUTO. CAL** is displayed at the base of the display screen during the scan distance operation, indicating that you are working in scan distance mode.

NOTE:

The reading of the actual target height may not be exact; for example, a target height of 6 m may give a reading of 5.998.

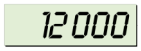
➢ To set scan distance:

	Press/Action	Display	Explanation
⇨	From the default screen, press ENT. and NEXT simultaneously.	SEARCH and AUTO. CAL	Displayed temporarily while SmartScan searches for an interfering signal.

NOTE:

Do not press any key while the **SEARCH** message is displayed.

⇨	(Wait a few seconds.)	For example, 3.227	Displays the depth of the interfering signal.
⇨	NEXT	SEARCH	Saves the interfering signal, then searches again and displays the next reading. Continue

	Press/Action	Display	Explanation
			this process to save up to eight interference readings.
⇨		For example, 	Actual target height reading indicates that there are no more interfering signals.
⇨			Saves the true echo value and completes the scan distance operation.

NOTE:

Pressing the NEXT button saves identified interferences. Pressing the ENT. button exits the function while saving the true echo value.

Clearing the Scan Distance Values

The **AUTO** function enables you to clear all saved scan distance values. (Refer to *Setting the Scan Distance Values*, page 74, for a description of how to set the scan distance values.)

➢ **To clear scan distance values:**

	Press/Action	Display	Explanation
⇨		AUTO.	With the required option flashing.
⇨	ENT.		Clears the scan distance values.

NOTE:

If the AUTO. indication at the base of the default display screen is lit, it might be a sign of acoustic interferences in the application. It is likely that SmartScan will overcome these interferences (i.e. display a correct value), by using a different transmission sequence.

Viewing Processor Information

You can view the version number and absolute address for each of the three processors contained in SmartScan, as follows:

- **Screen processor**, indicated by **S** before the code
- **Main processor**, indicated by **h** before the code
- **Co-processor**, indicated by **C** before the code

➢ **To view processor information:**

	Press/Action	Display	Explanation
⇨	In the main menu display, press BACK and NEXT simultaneously.	000.000	
⇨	ENT. or ESC. BACK or NEXT	000.003	Use to enter the value **000.003**.
⇨	Press ENT. on the far-right digit.	For example, S 5.020	The version number of the screen processor is displayed.
	BACK or NEXT	For example, S b2E0	Use to scroll through the version number and absolute address for each processor.
⇨	ESC.		Press at any time to return to the main menu.

Chapter 4

SmartScan Open Channels

This chapter describes how to set flow measurement parameters for open channels using SmartScan 50O models, and explains the flume/weir codes methodology used when setting up flow measurements.

NOTE:

Refer to *Chapter 3, Basic Setup*, for an explanation of accessing and using the SmartScan main menu and function buttons.

Selecting the Flow Measurement Settings

The **PARSH.FLUM** function in the main menu enables you to select one of the preset flumes/weirs settings for flow measurements.

When setting flow-measurement parameters, the flume/weir type value (**X**) is entered first, followed by the letter (**U**) or (**E**) as an indication for American or European open channel flow standard and followed by the code value (**YY**) that represents the appropriate flume/weir dimensions, in the following format: XE.YY. The default is European standard. The open channel types and codes are described in *Open Channels Flow Measurements*, page 81 .

If you wish to insert custom flume measurements, you must enter **.001** for this function. This entry will automatically initiate an additional menu function (**Pr 1**), enabling manual insertion of custom flume values in an accordance table, as described in *Chapter 5, Additional Features.*

➢ **To select the flow measurement settings:**

	Press/Action	Display	Explanation
⇨		PARSH.FLUM	With the required option flashing in the main menu.
⇨	ENT.	.001	Displays the last saved flow measurement setting or default value.
⇨	BACK or NEXT		Use to select a new type value (X).
⇨	ENT.	.001	The last two digits of the display flash.

	Press/Action	Display	Explanation
⇨	BACK or NEXT		Use to select a new flume/weir length code (YY), which corresponds to the type (X) previously selected. (The two digits are modified as one unit.)
⇨	ENT.		The selected values are saved.

Open Channels Flow Measurements

The flume/weir type code methodology used when setting up open channels is based on three digits: **X E/U YY**

Where:

X refers to the particular flume/weir type

E/U refers to European or American standard

YY refers to the specific flume/weir dimensions

Flume/Weir Types

This is the first value (X) entered for the **PARSH.FLUME** function. The following flume/weir types are available both in European and American standard:

Type (X)	European Standard (E) Pages 83-91	American Standard (U) Pages 93-100
1	Rectangular Suppressed Sharp-Crested Weir, Page 83	Rectangular Suppressed Sharp-Crested Weir, Page 93
2	Rectangular Contracted Sharp-Crested Weir, Page 84	Rectangular Contracted Sharp-Crested Weir, Page 94
3	Trapezoidal (Cipolletti) Sharp-Crested Weir, Page 85	Trapezoidal (Cipolletti) Sharp-Crested Weir, Page 95
4	V-notch (Triangular) Sharp-Crested Weir, Page 86	V-notch (Triangular) Sharp-Crested Weir, Page 96
5	Khafagi-Venturi Flume, Page 87	Parshall Flume, Page 97
6	Parshall Flume, Page 88	Palmer Bowlus Flume Trapezoidal Throat Cross-Selection, Page 98
7	Palmer Bowlus Flume Trapezoidal Throat Cross-Selection, Page 89	H Flume, Page 99
8	H Flume, Page 90	Leopold-Lagco Flume, Page 100
9	Neyrpic Venturi Flume/Long-Base Weir, Page 91, 92	

Flumes/Weirs - European Standard

Rectangular Suppressed Sharp-Crested Weir (Type 1)

Code (YY)	Crest Length (cm)
01	20
02	40
03	60
04	80
05	100
06	150
07	200
08	300

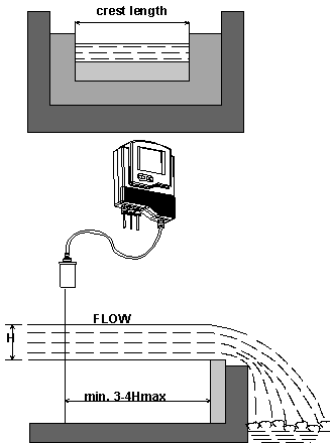


Figure 16: Rectangular Suppressed Sharp-Crested Weir

Rectangular Contracted Sharp-Crested Weir (Type 2)

Code (YY)	Crest Length (cm)
01	20
02	30
03	40
04	50
05	60
06	80
07	100
08	150
09	200
10	300

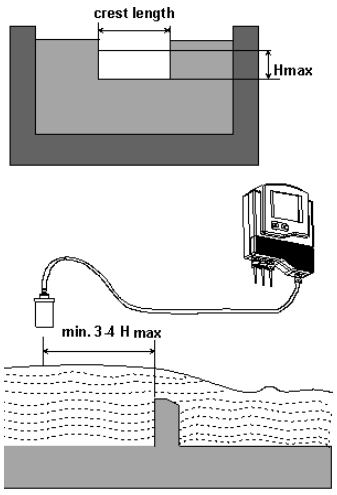


Figure 17: Rectangular Contracted Sharp-Crested Weir

Trapezoidal (Cipolletti) Sharp-Crested Weir (Type 3)

Code (YY)	Crest Length (cm)
01	30
02	45
03	60
04	80
05	100
06	150
07	200
08	300

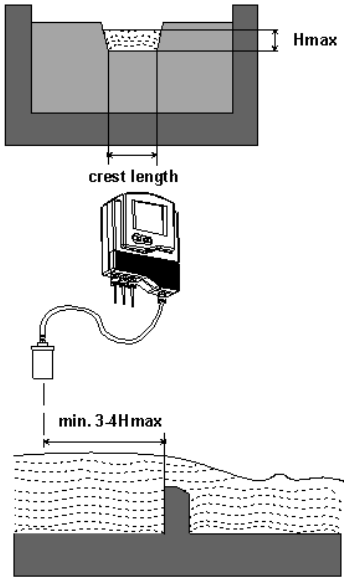


Figure 18: Trapezoidal (Cipolletti) Sharp-Crested Weir

V-Notch (Triangular) Sharp-Crested Weir (Type 4)

Code (YY)	V-Notch Angle (º)
01	90
02	60
03	53.8
04	45
05	30
06	28.4
07	22.5
British Standard	
08	90
09	45
10	22.5

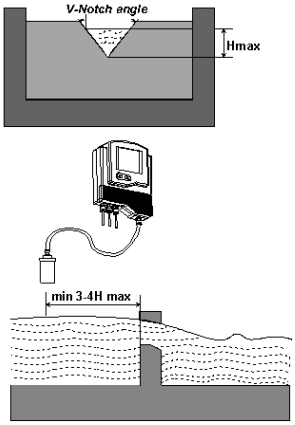


Figure 19: V-Notch (Triangular) Sharp-Crested Weir

Khafagi-Venturi Flume (Type 5)

Code (YY)	Flume Type	b0 (cm)
01	QV 302	12
02	QV 303	30
03	QV 304	40
04	QV 305	50
05	QV 306	60
06	QV 308	80
07	QV 310	100
08	QV 313	130
09	QV 316	160

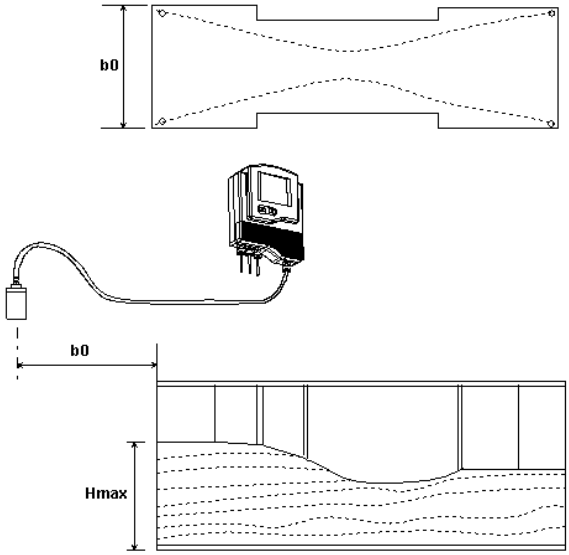


Figure 20: Khafagi-Venturi Flume

Parshall Flume (Type 6)

Code (YY)	Throat Width (in)
01	1
02	2
03	3
04	6
05	9
06	12
07	18
08	24
09	36
10	48

Code (YY)	Throat Width (in)
11	60
12	72
13	96
14	120
15	144

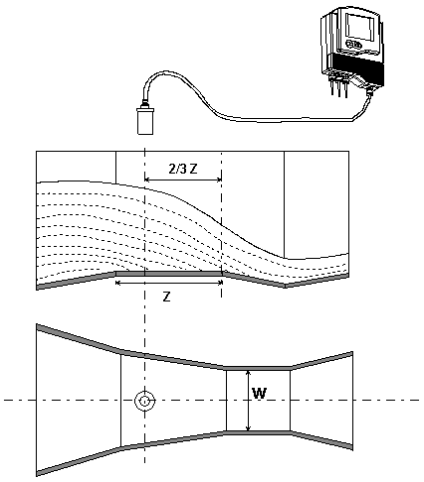


Figure 21: Parshall Flume

Palmer Bowlus Flume Trapezoidal Throat Cross-Selection (Type 7)

Code (YY)	Conduit Diameter (in) D
01	6
02	8
03	10
04	12
05	15
06	18
07	21
08	24
09	27
10	30

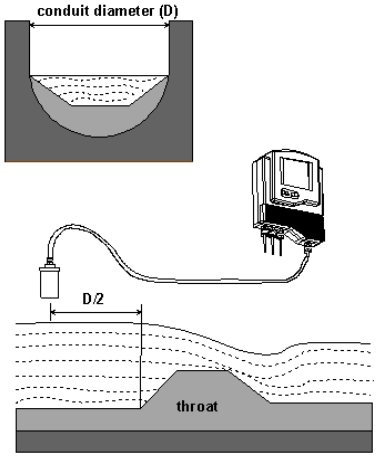


Figure 22: Palmer Bowls Flume Trapezoidal Throat Cross-Selection

H Flume (Type 8)

Code (YY)	Flume Size (ft)	Measurement Point (cm)
01	0.5	5
02	0.75	7
03	1	9
04	1.5	14
05	2	18
06	2.5	23
07	3	28
08	4.5	41

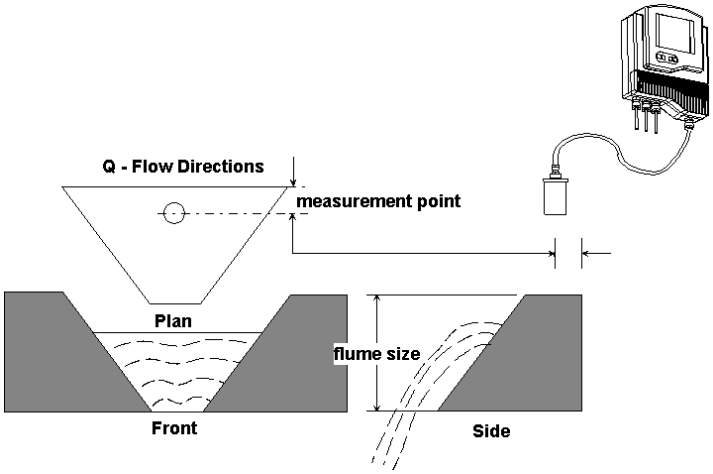


Figure 23: H Flume

Neyrpic Venturi Flume/Long-Base Weir (Type 9)

Neyrpic Venturi Flume

Code (YY)	Venturi Flume Type
01	1253AX
02	1253AY
03	1253AZ
04	1253A
05	1253B
06	1253C
07	1253D
08	1253E
09	1253F

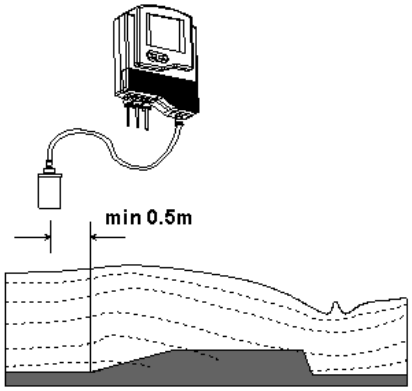


Figure 24: Neyrpic Venturi Flume

Long-Base Weir

Code (YY)	Long-Base Weir Type
10	1245A
11	1245B
12	1245C
13	1245D

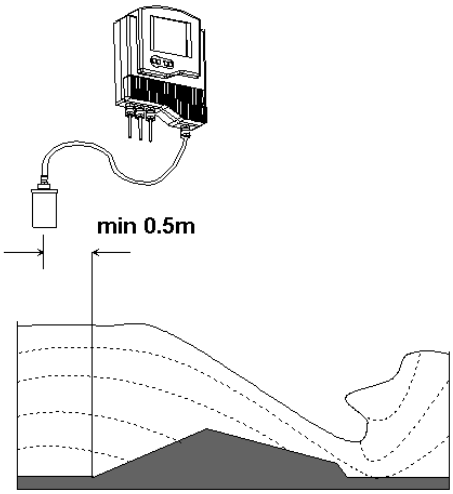


Figure 25: Long-Base Weir

Flumes/Weirs – American Standard

Rectangular Suppressed Sharp-Crested Weir (Type 1)

Code (YY)	Crest Length (in)
01	12.00
02	18.00
03	24.00
04	30.00
05	36.00
06	48.00
07	60.00
08	72.00
09	96.00

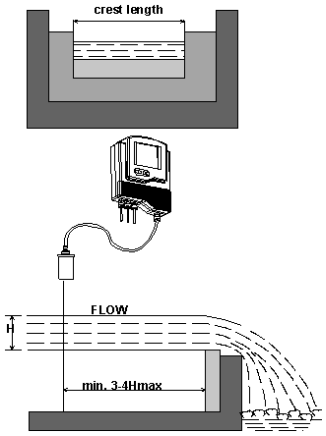


Figure 16: Rectangular Suppressed Sharp-Crested Weir

Rectangular Contracted Sharp-Crested Weir (Type 2)

Code (YY)	Crest Length (in)
01	12.00
02	18.00
03	24.00
04	30.00
05	36.00
06	48.00
07	60.00
08	72.00
09	96.00

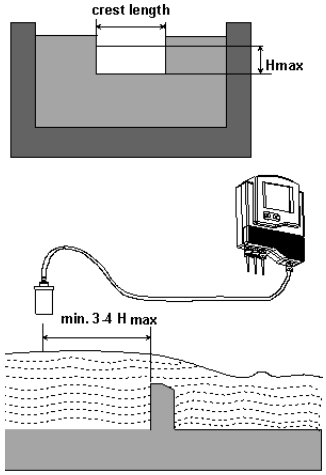


Figure 17: Rectangular Contracted Sharp-Crested Weir

Trapezoidal (Cipolletti) Sharp-Crested Weir (Type 3)

Code (YY)	Crest Length (in)
01	12.00
02	18.00
03	24.00
04	30.00
05	36.00
06	48.00
07	60.00
08	72.00
09	96.00

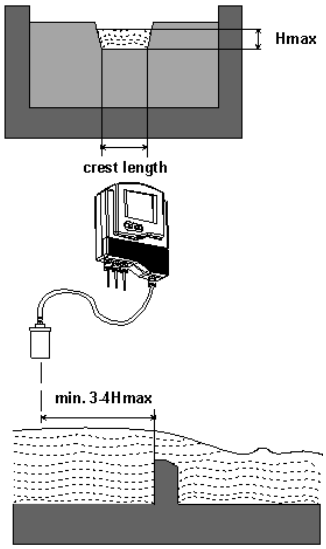


Figure 18: Trapezoidal (Cipolletti) Sharp-Crested Weir

V-Notch (Triangular) Sharp-Crested Weir (Type 4)

Code (YY)	V-Notch Angle (º)
01	90
02	60
03	45
04	30
05	22.5

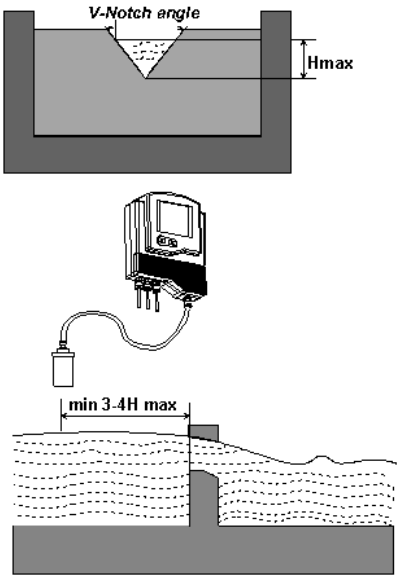


Figure 19: V-Notch (Triangular) Sharp-Crested Weir

Parshall Flume (Type 5)

Code (YY)	Throat Width (in)
01	1
02	2
03	3
04	6
05	9
06	12
07	18
08	24
09	30
10	36
11	48

Code (YY)	Throat Width (in)
12	60
13	72
14	96
15	120
16	144

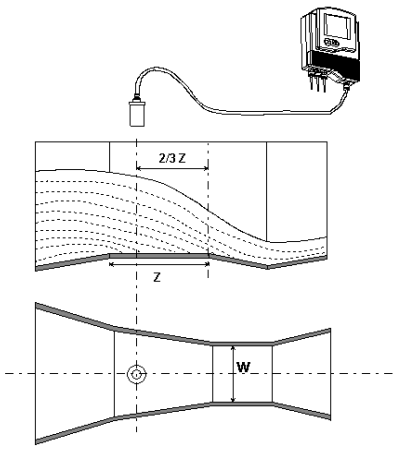


Figure 20: Parshall Flume

Palmer Bowlus Flume Trapezoidal Throat Cross-Selection (Type 6)

Code (YY)	Conduit Diameter (in) D
01	4
02	6
03	8
04	10
05	12
06	15
07	18
08	21
09	24
10	27

Code (YY)	Conduit Diameter (in) D
11	30
12	36
13	42
14	48
15	60
16	72

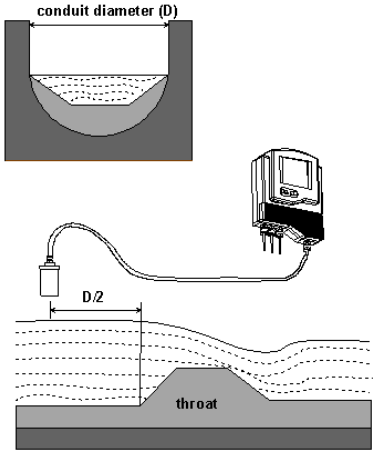


Figure 21: Palmer Bowls Flume Trapezoidal Throat Cross-Selection

H Flume (Type 7)

Code (YY)	Flume Size (in)	Measurement Point (in)
01	6	1.96
02	9	2.75
03	12	3.54
04	18	5.51
05	24	7.08
06	30	9.05
07	36	11.02
08	54	16.14

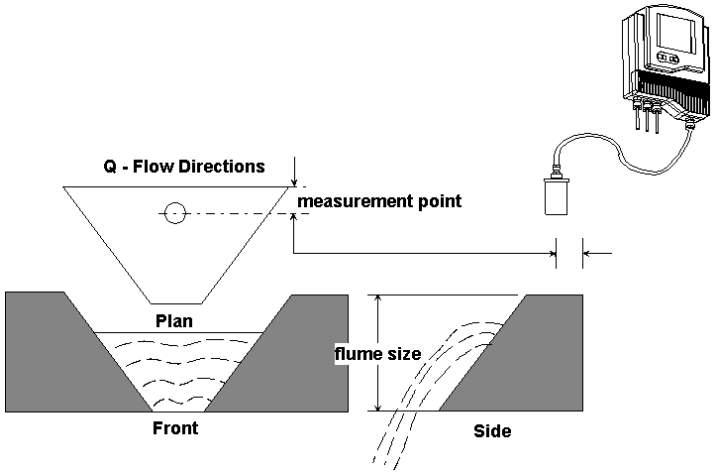


Figure 22: H Flume

Leopold-Lagco Flume (Type 8)

Code (YY)	Crest Length (in)
01	4
02	6
03	8
04	10
05	12
06	15
07	18
08	21
09	24
10	30

Code (YY)	Crest Length (in)
11	36
12	42
13	48
14	54
15	60
16	66
17	72

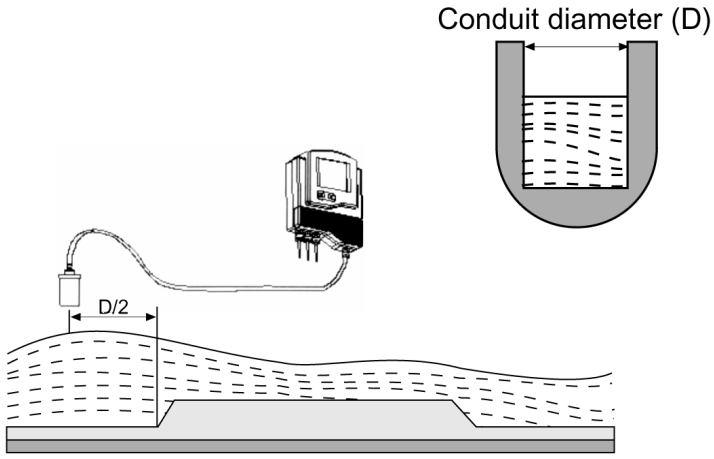


Figure 26: Leopold Lagco Flume

Chapter 5

Additional Features

This chapter describes the functions available in SmartScan's additional menu. The additional menu functions enable you to calibrate SmartScan to perform the following tasks:

- ✦ Present scanning results in volume format.
- ✦ Present scanning results as a total accumulative value for flow.
- ✦ Present scanning results as an accumulative sum for diameter.
- ✦ Calculate volume for different tank types.
- ✦ Calculate flow measurements for custom flumes.
- ✦ Calculate results in alternative measurement units.
- ✦ Adjust results when there is interference from a conical tank ending.
- ✦ Allow compensation of different types of gas.

NOTE:

The additional menu functions are available via the SmartScan display.

Accessing the Additional Menu

The additional menu functions are accessed from the default screen using the function buttons, after entering the SmartScan password code, indicated in Chapter 3.

➢ **To access the additional menu:**

	Press/Action	Display	Explanation
⇨	ENT. (after entering the password code).	1	Required option to enter setup mode.
⇨	ENT.	1 flashes for approximately 5 seconds, then 3 is displayed.	
⇨	Use BACK or NEXT to change the display to 4, then press ENT.	4 flashes for approximately 5 seconds, then Pr 0 is displayed.	Use BACK or NEXT to scroll through the additional menu options.

NOTE:

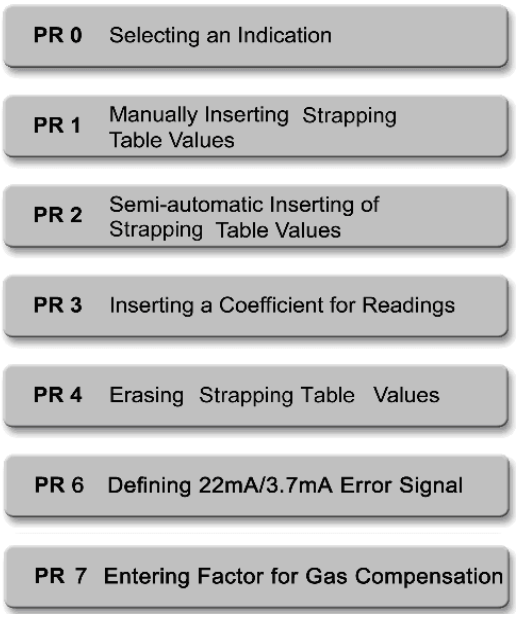
For SmartScan 50 models: Press once on the **ESC.** button to return to the main menu and twice to return to the default screen.

For SmartScan 25 models: Press once on the **ESC.** button to return to the default screen.

Setting Additional Menu Options

You can access and modify the additional menu functions in any order. The options available within the functions, and their practical application for SmartScan functioning, are dependent on the SmartScan model being used.

The following functions are available in the SmartScan additional menu.


PR 0 Selecting an Indication
PR 1 Manually Inserting Strapping Table Values
PR 2 Semi-automatic Inserting of Strapping Table Values
PR 3 Inserting a Coefficient for Readings
PR 4 Erasing Strapping Table Values
PR 6 Defining 22mA/3.7mA Error Signal
PR 7 Entering Factor for Gas Compensation

Refer to page 104.
Refer to page 106.
Refer to page 108.
Refer to page 110.
Refer to page 112.
Refer to page 113.
Refer to page 115.

Pr 0 Selecting an Indication

Using function **Pr 0**, you can modify the SmartScan default display to show indications for volume, total flow or diameter sum. Select the required indication mode, as follows:

- **Ind 1: Volume mode**. The default screen indicates the volume reading, by means of a value displayed in the numerical area and the level of the tank graphic.

NOTE:

When this mode is selected, you can use **Pr 1**or **Pr 2** to customize volume measurement, as described in *Manually Inserting Strapping Table Values*, page 106, and *Semi-automatic Inserting of Strapping Table Values*, page 108.

- **Ind 2: Totalization for flow mode** (currently available for and 50O models SW ver.5.06 onwards). The default screen indicates the value for total accumulative flow, calculated from the point of entering the mode, and updated every 30 seconds.
  The total amount of flow is shown as a nine-digits value in two separate screens: high and low. The high digits are indicated by an H, followed by the first five digits of the value; the low digits are indicated by an L, followed by the last four digits of the value. You can toggle between the high and low screens using the NEXT and BACK buttons (there is no level indication in the tank graphic for this mode.)
  In addition, you can toggle between level, distance and flow values using the same buttons. There are three options available in this mode that allows you to, either reset the totalization counter, activate it or deactivate it. Use the NEXT and BACK buttons to toggle between options, and ENT. to select the desired option:

- **0**: Resets the totalization value
- **1**: Activates the totalization mode
- **2**: Deactivates the totalization mode

➢ **To select an indication:**

	Press/Action	Display	Explanation
⇨		Pr 0	Required menu selection.
⇨	ENT.	For example, Ind. 1	Displays an indication option.
⇨	BACK or NEXT	For example, Ind. 2	Use to select the required indication option.
⇨	ENT.		Saves the selected option and returns to the additional menu.

Pr 1 Manually Inserting Strapping Table Values

The **Pr 1** function enables you to manually create a strapping table of distance points for either volume calculations or custom flume measurements, for the SmartScan 25O and 50O models.

The strapping table is used for manual insertion of distance/volume values when **IND 1** was selected as the value for **Pr 0**, as described in *Selecting an Indication*, page 104. Manual insertion is applicable when the ratio between the distance and volume of the tank is known or for applications such as custom-shaped tanks. Up to 24 linear points can be entered in the strapping table, starting from the smallest distance and largest volume for point 1 (which is the closest point to the sensor). The distance should increase and the volume decrease with each subsequent entry.

The strapping table automatically enters custom flume mode after **.001** is entered as the **PARSH.FLUM** value in the main menu (refer to *Chapter 4, Open Channels Setup)*. In this mode, the table is used to manually insert up to 24 distance/custom flume measurement values, in the same way as for distance/volume values. Any custom flume measurement can be entered, as long as the maximal value entered is the measurement of the distance between the sensor and the flume.

NOTES:

You can exit **Pr 1** at any stage by pressing the **ESC** button. However, it is recommended that you first enter at least 8 points for the function. Values are entered in **Distance** units.

When working in custom flume mode, exiting **Pr 1** returns you to the main menu.

➢ **To insert strapping table values manually:**

	Press/Action	Display	Explanation
⇨		Pr 1	Required menu selection.
⇨	ENT.	P 1	Setup for the first point.
⇨	ENT.	DIST. and 000.000	Displays 0 or the previously saved value.
⇨	ENT. or ESC. BACK or NEXT		Use to enter the distance value (in the measurement unit defined for SmartScan operation).
⇨	Press ENT. on the far-right digit to save the value.	000000	Displays 0 or the previously saved volume value/custom flume measurement. Using the buttons as described for the distance value (above), enter up to six pre-decimal point digits to represent the value that corresponds to the entered distance.
⇨	Press ENT. on the far-right	For example, 056.000	The last three digits entered in the previous step are displayed before the decimal

	Press/Action	Display	Explanation
	digit.		point. Using the buttons, you can enter *one* digit *after* the decimal point.
⇨	Press ENT. after entering one digit after the decimal point.	P 2	Repeat the above procedure for each point to be inserted in the table.

Pr 2 Semi-automatic Inserting of Strapping Table Values

The **Pr 2** function enables you to create a strapping table for distance/volume values using distance values measured automatically by SmartScan, rather than entered manually as described in the previous section. This method enables more accurate volume indications than the manual method, but entails slower calibration due to the need for additional instruments, such as a flow meter.

This function should be started when the tank is full, so that point 1 is calculated for the smallest distance/highest volume. The subsequent points are calculated as the tank empties.

NOTES:

You can exit **Pr 2** at any stage by pressing the **ESC** button. However, it is recommended that you first enter at least eight points for the function.

The same strapping table is used for functions **Pr 1** and **Pr 2**. Any change made from either of the functions will be applied to the one mutual table.

A minimum of eight (8) strapping points should be entered into the table to receive accurate readings. Maximal number of strapping points to be entered is twenty four (24).

➢ To insert values semi-automatically:

	Press/Action	Display	Explanation
⇨		Pr 2	Required menu selection.
⇨	ENT.	P 1	Setup for the first point.
⇨	ENT.	DIST. and 000.000 or the previously saved value.	Enters distance reading mode.
⇨	ENT.	For example, 3.227	Displays the distance SmartScan is currently scanning.
⇨	Press ENT. to save the current scanned distance	000000	Displays 0 or the previously entered volume value. Enter the volume value, as

	Press/Action	Display	Explanation
	in this table entry.		described for the manual procedure on page 103.
⇨	ENT.	P 2	Repeat the above procedure for each point to be inserted in the table.

NOTES:
4-20mA parameters in volume mode are identical to the volume values entered in the strapping table.

Pr 3 Inserting a Coefficient for Readings

Before you define a coefficient you must first define volume mode (PRO, ind1) and then insert a strapping table.

The **Pr 3** function enables you to enter a coefficient value, K, which can be used for three different options. For each option, the entered K value is used by SmartScan in the following formula: **Y = K(X)**

The options and their variables are as follows:

- **Measurement in kilograms:** The variables represent the following values:

  Y = Result in kilograms

  K = Specific gravity

  X = Volume

- **Calculation using an alternative measurement unit:** The variables represent the following values:

  Y = Result according to the new measurement unit

K = The factor difference between the previous measurement unit and the current unit

X = Result according to the previous unit (such as meters, feet or inches)

✦ **Converting volume values to percentages and vise versa:**

Variables represent volume values displayed in percentages:

Y = Measured values displayed in percentage

K = $\frac{100}{\text{Factor of the maximal volume}}$

X = Volume values as measured in the strapping table

Variables represent percentages displayed in volume values:

Y = Percentage displayed in volume values

***K** = $\frac{\text{Factor of the maximal volume}}{100}$

X = Percentage values

* Using Gaz factor as in Appendix B

➢ **To insert the K coefficient:**

	Press/Action	Display	Explanation
⇨		Pr 3	Required menu selection.
⇨	ENT.	00 1.000	Displays the default K value.
⇨	ENT. or ESC.		Use to enter a K value from 0.001 to 99.999.

Press/Action	Display	Explanation
BACK or NEXT		

Pr 4 Erasing Strapping Table Values

The **Pr 4** function erases all values entered in the strapping table using functions **Pr 1** or **Pr 2**, as described on pages 106 and 108.

➢ **To erase strapping table values:**

Press/Action	Display	Explanation
	Pr 4	Required menu selection.
ENT.	ErASE	Erases all strapping table values.
ENT.	000.000	Displays 0 for a few seconds, indicating that the values have been erased, and then returns to the additional menu.

NOTES:
Entering a gas factor parameter will automatically compensate the distance values defined in the Strapping Table and in the K-Factor

Pr 6 Defining 22mA/3.7mA Signal Error Messages

The **Pr 6** function allows you to define whether the following signal error indications Near Zone and Lost Echo will be active when the current output reaches 22mA or 3.7mA. The SmartScan default setting enables 22mA analog current and error messages to appear on its LCD display.

Near Zone - whenever the level is below the defined Dead Zone (depending on the SmartScan model you are using) FF FFF message will be displayed on the SmartScan's LCD.

Lost Echo - whenever the level falls below the programmed 4mA value (as defined in *Setting the 20mA/4mA Levels*, Page 61), or if the echo is lost, EE EEE message will be displayed on the SmartScan's LCD.

Tank Empty — whenever the tank is empty or when the measured distance is higher than the tank height. (typically in empty tanks with conic ending), EE EEE message will be displayed on the SmartScan's LCD.

You can choose to enable or disable these error messages and 3.7mA/22mA analog signals as follows:

- **0**: Enables 22mA signal error messages
- **1**: Enables 3.7mA signal error messages
- **2**: Disables signal error messages

➢ To select 22mA/3.7mA signal error messages:

	Press/Action	Display	Explanation
⇨		Pr 6	Required menu selection.
⇨	ENT.	000.000	22mA signal error messages will be activated.
⇨	ENT. or ESC. BACK or NEXT		Use to toggle between the options.

NOTE:
The factory default for Error Signal mode is disable.

Pr 7

Entering Factor for Gas Compensation in SmartScan 25 for volume only.

Function Pr.07 enables you to compensate for sound velocity changes in different types of gas. You can enter the appropriate factor for each type of gas listed on the 'Gas Factor Table' (Appen.B). For example, the sound velocity in air (in room temperature) is 343 m/sec and for Methane (Ch_4) 445.82 m/sec, therefore a factor of 445.82/343 = 1.29 should be entered to compensate for this type of gas. This factor will compensate in cases that the gas consists of 100% Methane. In case the gas is not pure, the sound velocity cannot be estimated and therefore a minor deviation could appear. It is recommended to use a reference measurement indicator (using a tape or other measuring device) and compare the measurement results between the SmartScan and the reference measurement indicator. If the result is correct, press ENT. If the accuracy deviation is higher than expected, continue and calibrate the factor to meet the gas maintained in the vessel. For example, if the gas consists of water and gas you can add +/- 0.01 to the factor figure already entered, to meet your application requirements.

The 'Gas Factor Table' (Appen.B) supports different types of gas. For any other type of gas, not included in this table, please consult with Solid AT Customer Support. (info@SolidAT.com)

NOTES:

The procedure of adjusting the gas factor parameter should be repeated until the desired measurement value is achieved. If neither ESC nor ENT buttons are pressed within 10 seconds, the original gas factor will be displayed.

Entering a gas factor parameter will automatically compensate the distance values defined in the Strapping Table and in the K-Factor. Once the factor entry is approved SmartScan will return to the Additional Menu screen.

➢ **To enter a gas compensation factor:**

	Press/Action	Display	Explanation
⇨		Pr 7	Required menu selection.
⇨	ENT.	001.000	Displays the default factor.
⇨	BACK or NEXT	For example, 001.260	A gas factor for Ammonia is entered.
⇨	ENT.	For example, 003.084	The displayed measurement value compensated including the gas factor will flash for 10 seconds.
⇨	ENT. or		To approve the gas factor entry.
⇨	ESC.	For example, 001.240	To adjust the gas factor.
⇨	ENT.		If the accepted distance is still not exact, press ESC and add/reduce again +/- 0.01 to the gas factor already defined. Or else, press ENT.

Chapter 6

SmartScan – Resetting configuration parameter

Step	operation	note
1.	Power-on	
2.	measurement	
3.	ENT +ESC	
4.	716	
5.	ENT	
6.	1	
7.	ENTx2	
8.	3	
9.	ENTx2	Main Manu
10.	Back+Next	
11.	000.000	
12.	ENTx5	
13.	000.000	
14.	Next	

15.	000.001	*to change*
16.	ENT	
17.	000.000	
18.	ENTx1	
19.	000.000	
20.	Next	*Change to Solid*
21.	000.001	
22.	ENT	*Enter for Solid* - wait
23.	000.001	
24.	ENT	
25.	000.001	
26.	Back	*Change to Liquid* - wait
27.	000.000	
28.	ENT	*Enter for Liquid*
29.	000.000	
30.	ESCx2	*Exit to Measurement*
31.	measurement	
32.	000.000	
33.	Reconfiguration	

Chapter 7

Troubleshooting SmartScan

This chapter describes the error messages displayed when an illegal value is entered for a SmartScan function, or when an option is selected that is not applicable for the specific SmartScan model you are using. If an illegal value is entered, the appropriate error message is displayed flashing while the level of the tank graphic on the bottom-right of the screen moves up from 0 to 100%. The numerical area then displays 000000, enabling you to enter a new value for the function. If an illegal option is selected, an error message is displayed while the tank graphic fills, and the display then reverts to the menu selection.

The possible error messages are as follows:

Error	Description
Err. 1	The value entered is greater than the maximum permitted value.
Err. 2	The value entered is less than the minimum permitted value.

Err. 3	The **Close** value entered for a relay is greater than the **Open** value entered for the relay.
Err. 4	The value entered for **4 mA** is equal to the value entered for **20 mA**.
Err. 5	The selected function/option is not applicable for the SmartScan model in use.
Err. 7	The value entered for the **20 mA**, **4 mA** or **Relay** function is greater than the tank height.
Err. 8	The value entered for the tank height is greater than the maximum value supported by the SmartScan model in use.
Err. 9	The measurement unit selected is not applicable for the SmartScan model in use.
Err. 10	The **Open** value entered for the relay is greater than the **Close** value entered for the relay (in **Distance** mode).
Err. 11	A strapping table was not entered under volume mode or a flume/weir type was not entered under flow mode.
EE EEE	The value entered for the tank height is smaller than the actual height, as measured by SmartScan.
AUTO.	If displayed at the base of the display screen, this indicates a problem with the current procedure, for example, acoustic interference.

22mA/3.7mA Signal Error Messages

The following list of messages will appear on the display and coincides with a 22mA or 3.7mA (depends on your set-up) analog current error output signal (the default is set to 22mA):

Error	Description
EE EEE	Tank is empty or echo is lost
FF FFF	The sensor is located near the dead zone

Appendix A

SmartScan Ranges

This appendix provides the maximum and minimum permitted values for the main menu functions in the SmartScan 50 and SmartScan 25 units.

Function	Permitted Values for SmartScan 25	Permitted Values for SmartScan 50
		Solid, Liquid and Flow Applications
Tank height (maximum) **Solids, liquids, flow**	**Standard Range:** 20 m /65 ft 25 m /82 ft **Long Range:** 30m/98ft 40 m/131 ft	**Solid:** 8.5 m/28ft **Liquid and Flow:** 12 m/39 ft
Tank height (minimum)	0.6 m/1.9 ft	0.4 m/1.3 ft
Relay	From 0 up to maximum tank height	From 0 up to maximum tank height

Function	Permitted Values for SmartScan 25	Permitted Values for SmartScan 50
		Solid, Liquid and Flow Applications
4 mA level	From 0 up to maximum tank height	From 0 up to maximum tank height
20 mA level	From 0 up to maximum tank height	From 0 up to maximum tank height
4 mA level for flow measurement	From 0 up to 55,500 m^3/h (244,200 G.P.M.)	From 0 up to 55,500 m^3/h (244,200 G.P.M.)
20 mA level for flow measurement	From 0 up to 55,500 m^3/h (244,200 G.P.M.)	From 0 up to 55,500 m^3/h (244,200 G.P.M.)
Manual	From -2 m up to 2 m	From -2 m up to 2 m

Appendix B

Gas Factor Table

This following table contains 33 different types of gas and their factor for compensating sound velocity. Entering the desired factor (refer to Chapter 5, *Additional Features* for more details) will immediately change the measurement results to fit your application requirements for measuring volume only.

Gas	Symbol	CAS No.	Factor
Acetic Acid	$C_2H_4O_2$	64-19-7	0.63
Acetone	C_3H_6O	67-64-1	0.63
Acetaldehyde	C_2H_4O	75-07-0	0.73
Acetyl Chloride	$C_2H_3C_1O$	75-36-5	0.54
Acetylene	C_2H_2	74-86-2	0.99
Ammonia	H_3N	7664-41-7	1.26
Argon	Ar		0.93
Benzene	C_6H_6	71-43-2	0.55
Bromine	Br_2		0.41

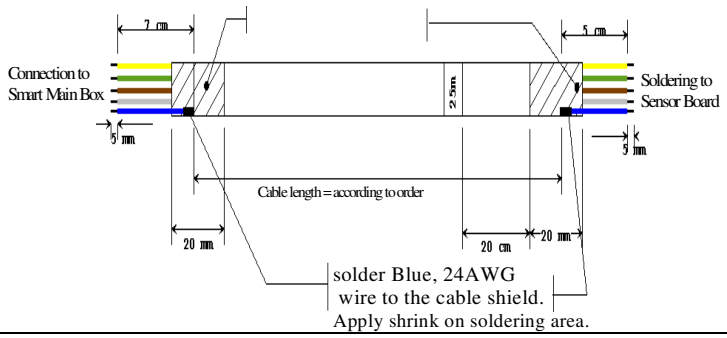
Gas	Symbol	CAS No.	Factor
Bromochlorodiflu oromrthane	Cbrclf2	353-59-3	0.38
Butanone	CH3COCH2CH3	78-93-3	0.56
Carbon Dioxide	CO2	124-38-9	0.78
Carbon Monoxide	CO	630-08-0	1.02
Carbon Tetrachloride	CCI4	56-23-5	0.39
Chlorine	Cl2		0.63
Dimethyl Ether	C2H6O	115-10-6	0.71
Ethane	C2H6	74-84-0	0.90
Ethanol	C2H6O	64-17-5	0.71
Ethylene	C2H4	74-85-1	0.96
Ethyl Acetate	C4H8O2	141-78-6	0.5
Helium	He		2.91
Hexan	C6H14	110-54-3	0.5
Hydrochloric Acid	HCI(+H2O)	7647-01-0	0.89
Hydrogen	H2		3.80
Hydrogen Sulfide	H2S	7783-06-4	0.89

Gas	Symbol	CAS No.	Factor
Isopropyl Alcohol	C3H8O	67-63-0	0.62
Methane	CH4	74-82-8	1.30
Methanol	CH4O	67-56-1	0.88
Methyl Hydrazine	CH6N2	60-34-4	0.71
Neon	Ne		1.30
Nitrogen	N2		1.02
Nitromethane	CH3NO2	75-52-5	0.63
Oxygen	O2		0.95
Propane	C3H8	74-98-6	0.73
Propanol	C3H8O	71-23-8	0.61
Sodium Bisulphite	NaHSO3	7631-90-5	0.51
Tetrahydrofuran	C4H8O	109-99-9	0.57
Toluene	C7H8 or C6H5CH3	108-88-3	0.5

Appendix C

Flexible Cable connector

Preparing sensor's cable



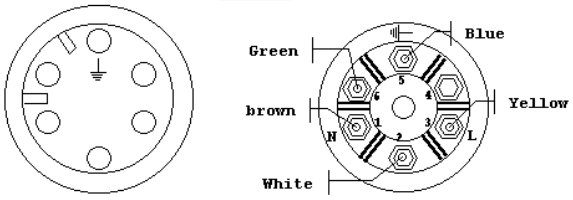
The flexible cable option allows users to increase the cable length of the sensor.

With this option the sensor is delivered with fixed 5 meter cable and connector set.

The user can purchase the extention cable locally (Helucable p.n. 16028) and extened the 5 meter cable.

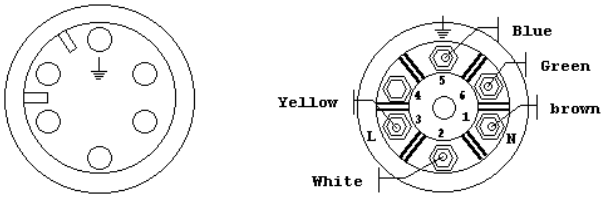
When the order includes longer cable adapter than the supplied cable a cable connector should be added

Male



The female part will be supplied separately, per the following:

Female



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